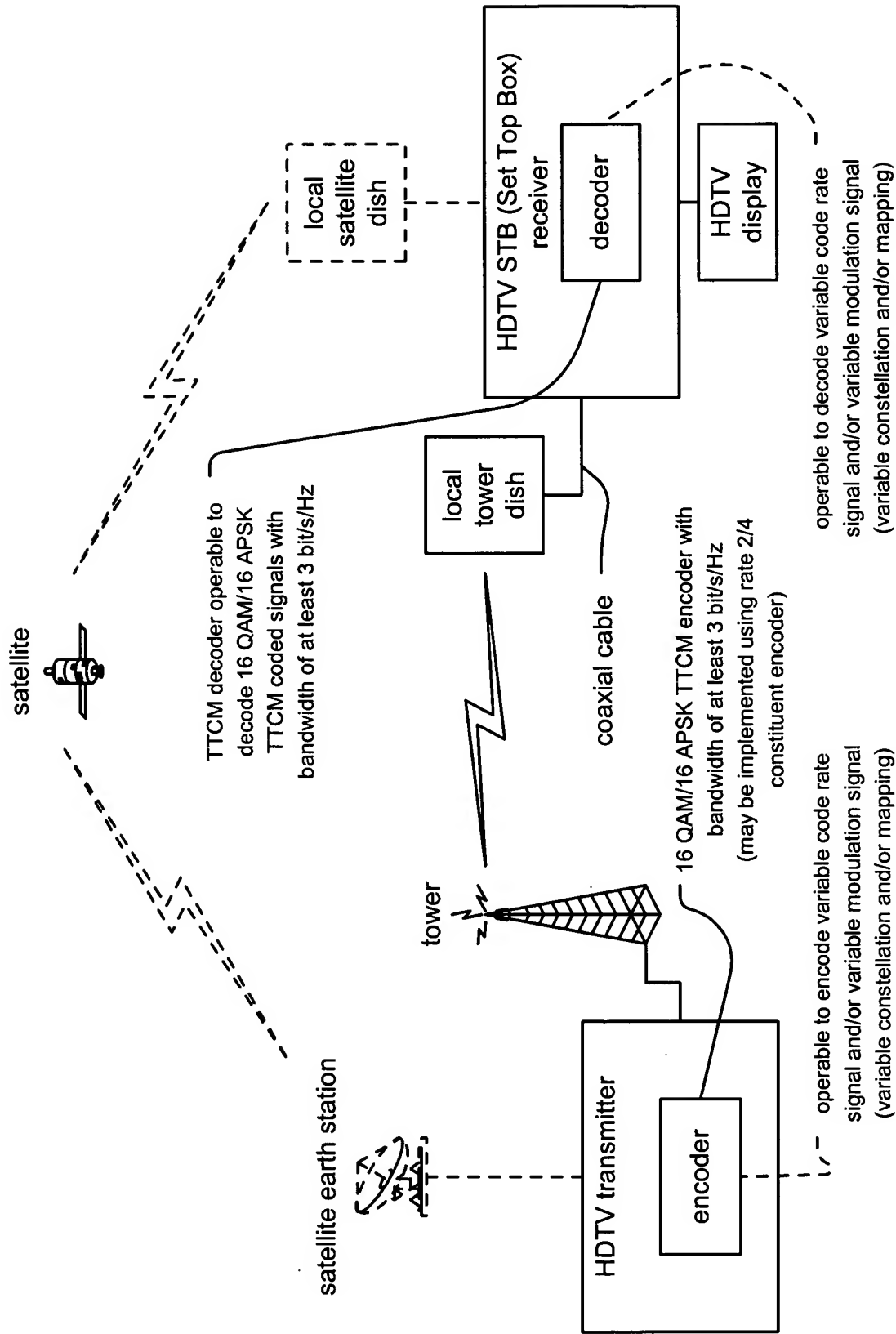


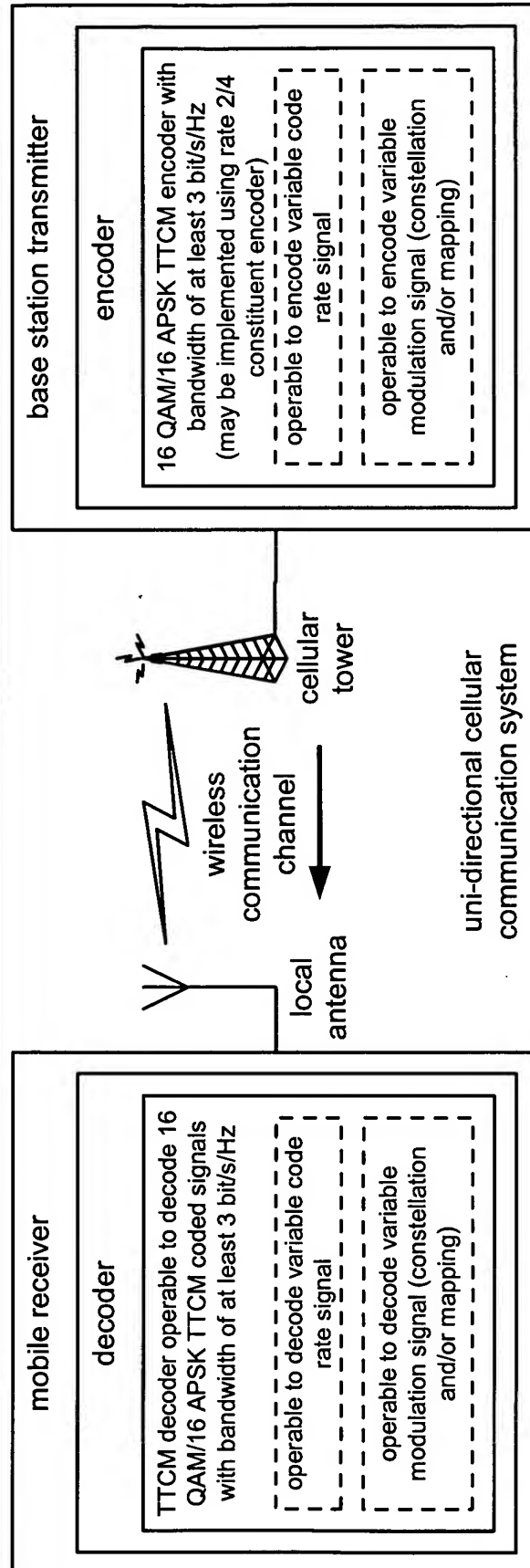
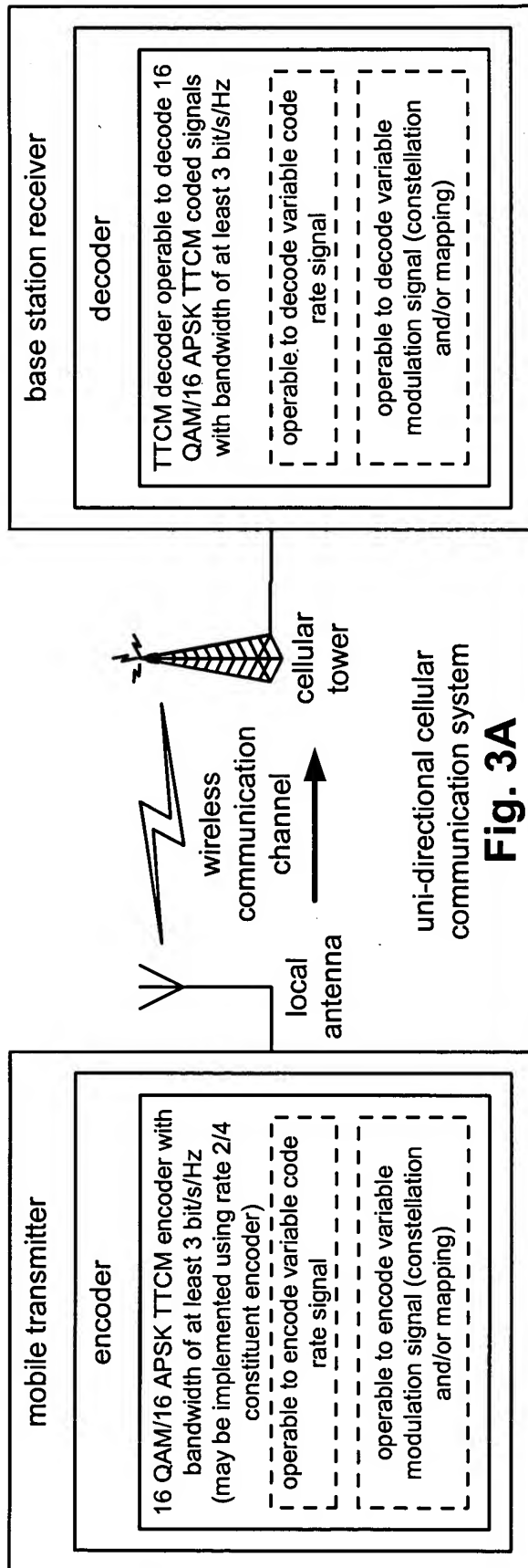
satellite communication system

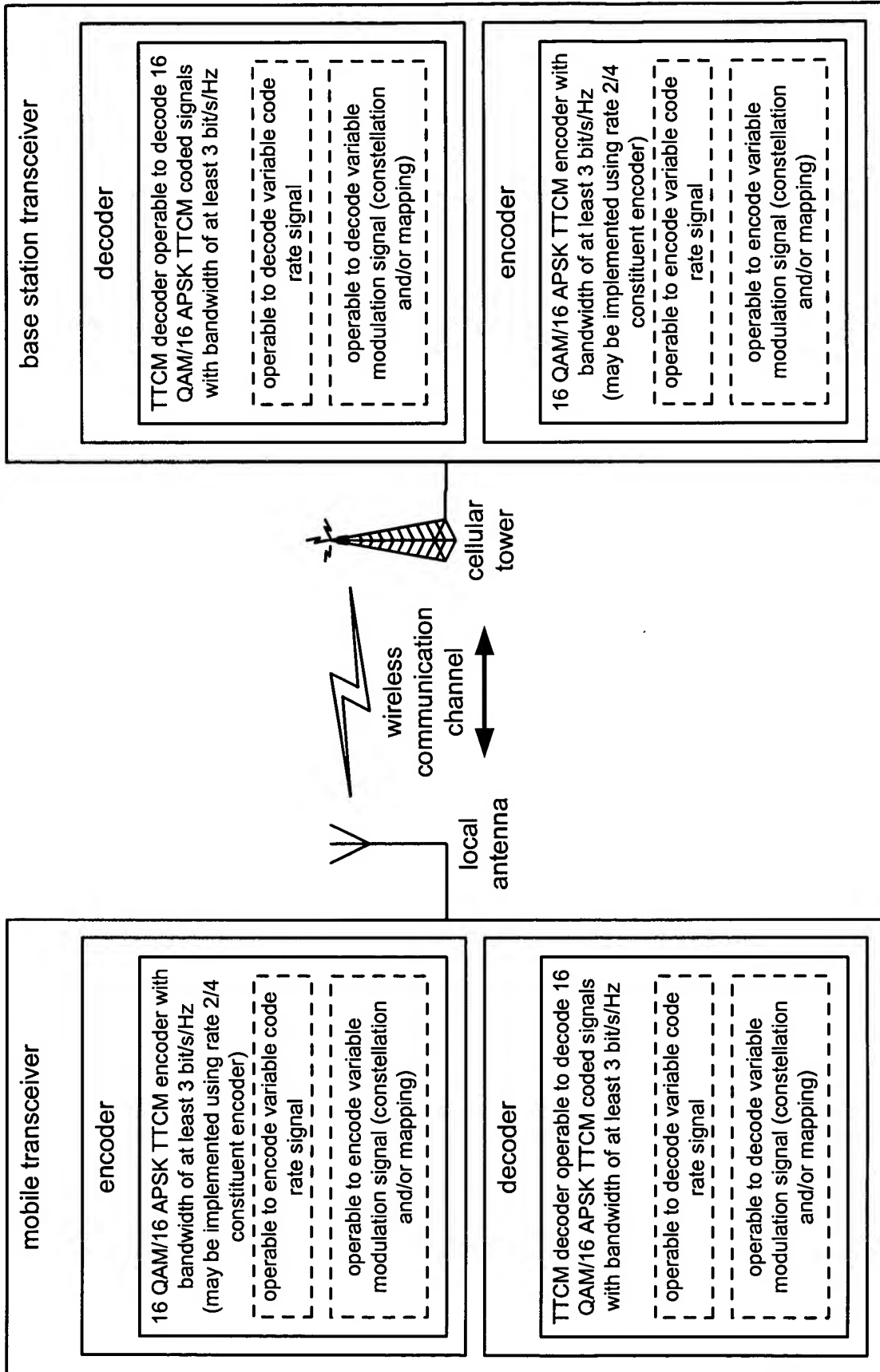
**Fig. 1**



HDTV (High Definition Television) communication system

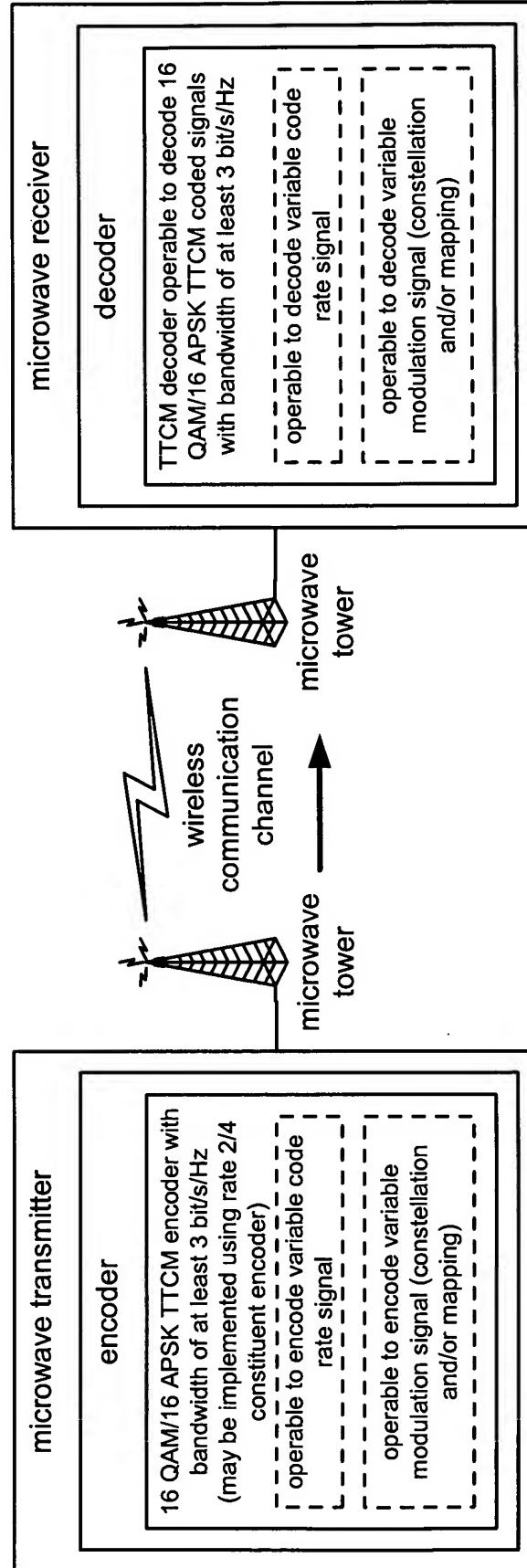
**Fig. 2**





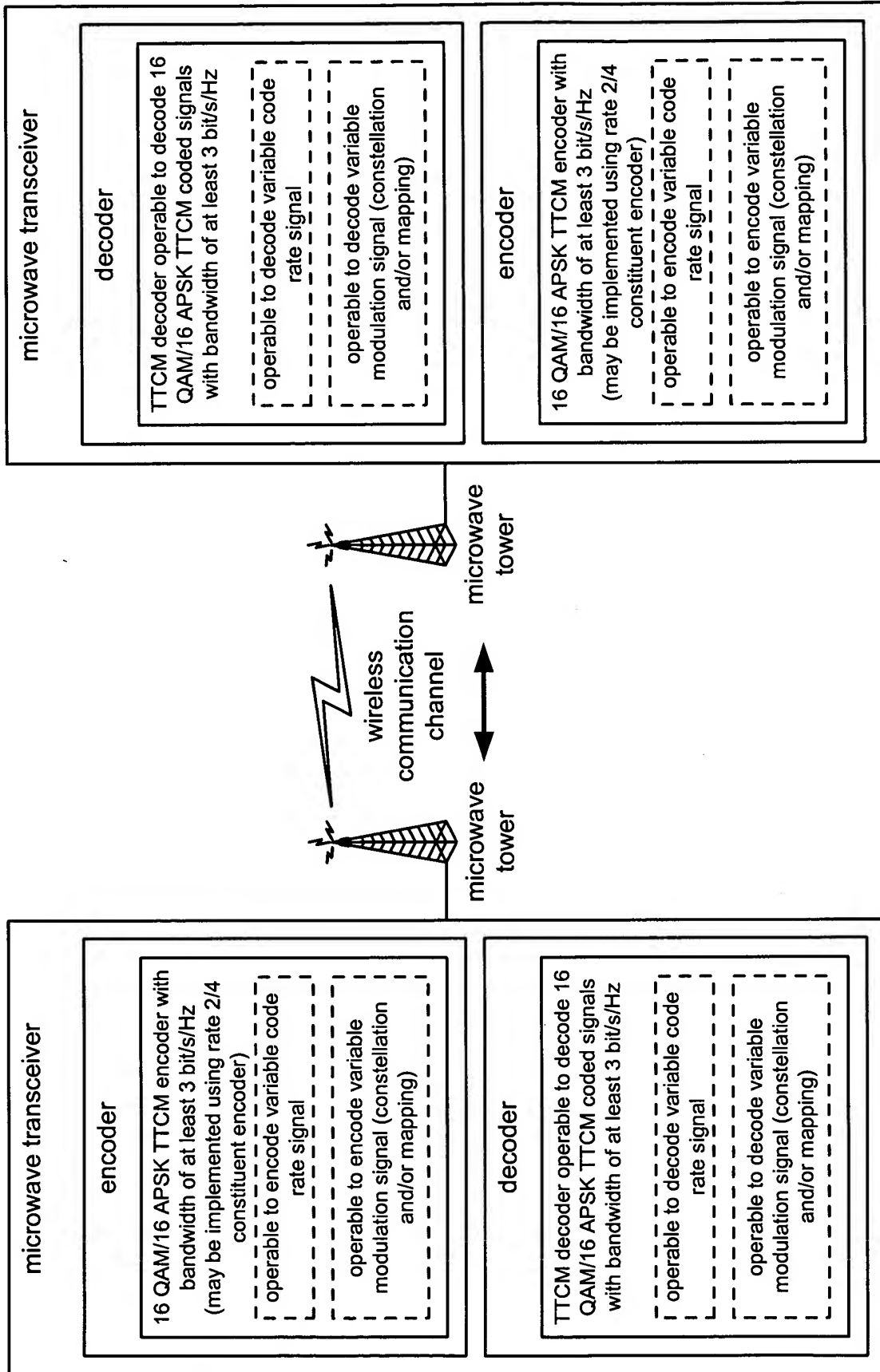
bi-directional cellular communication system

**Fig. 4**



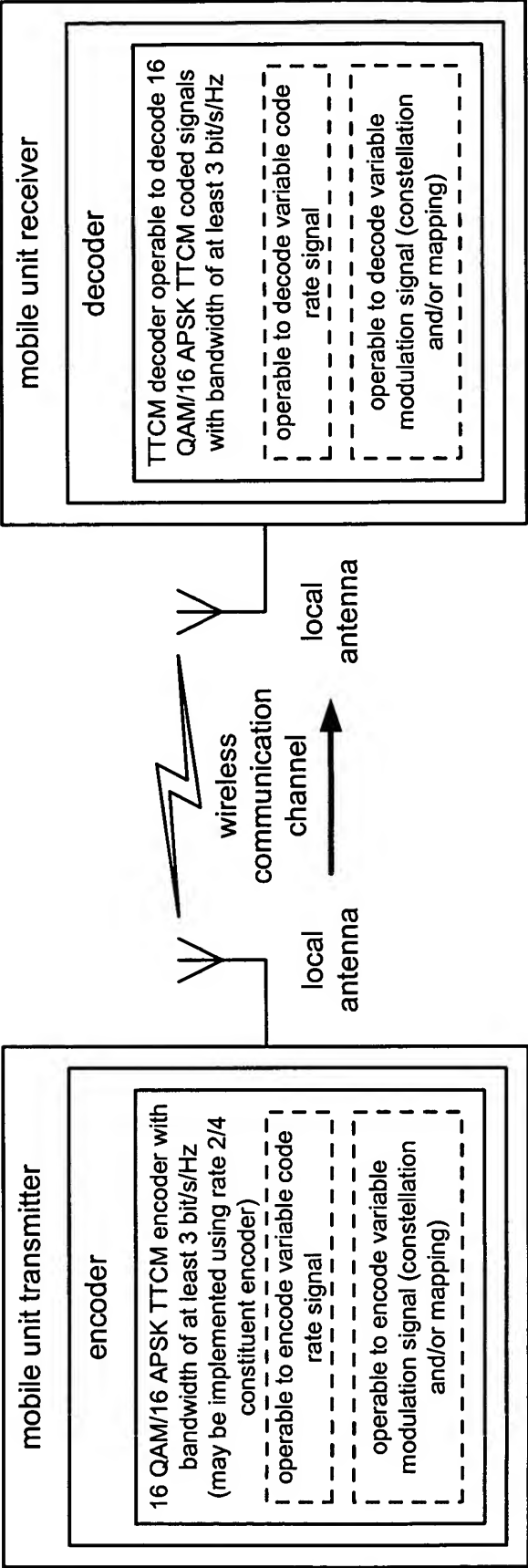
uni-directional microwave communication system

**Fig. 5**

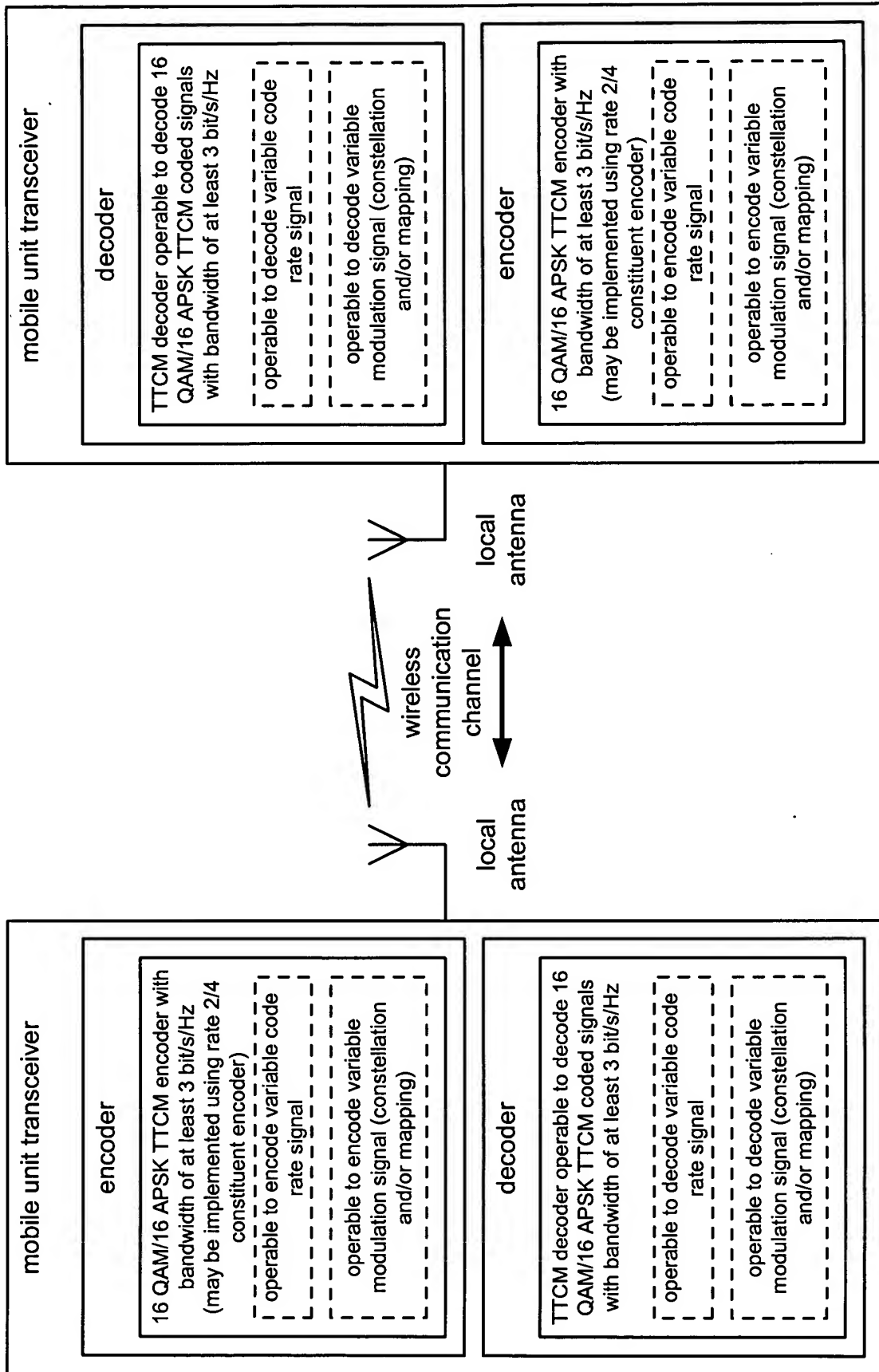


bi-directional microwave communication system

Fig. 6



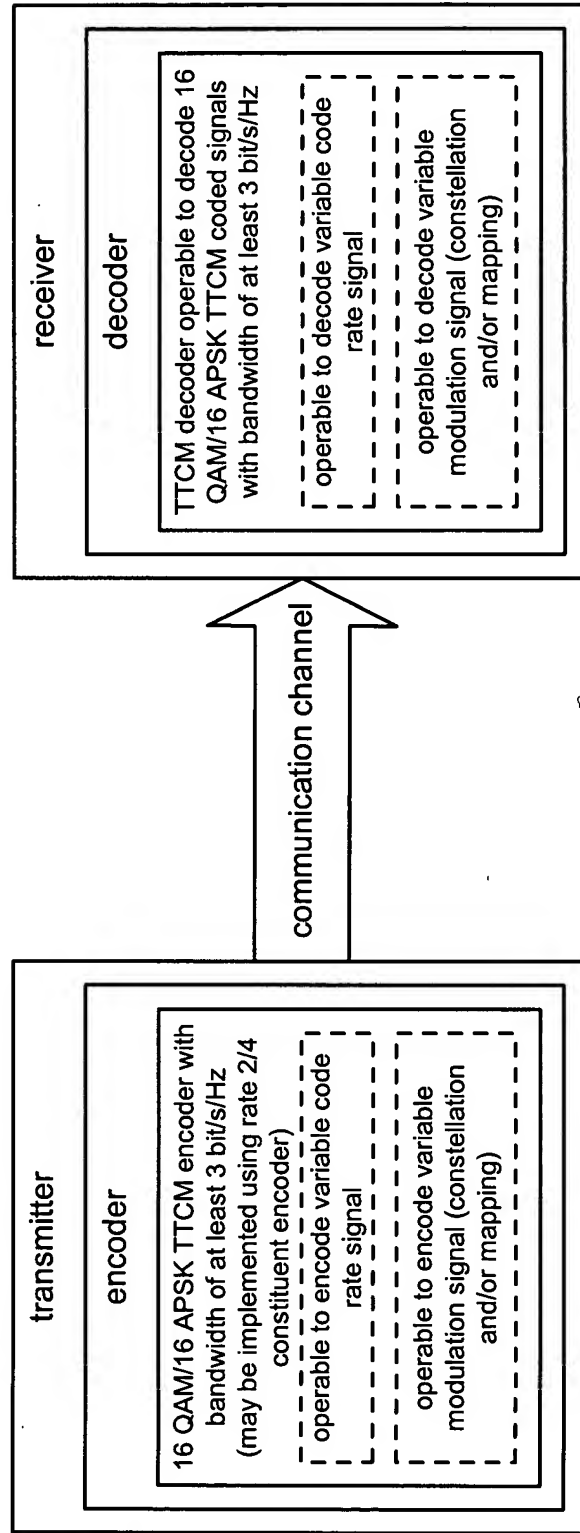
uni-directional point-to-point radio communication system  
**Fig. 7**



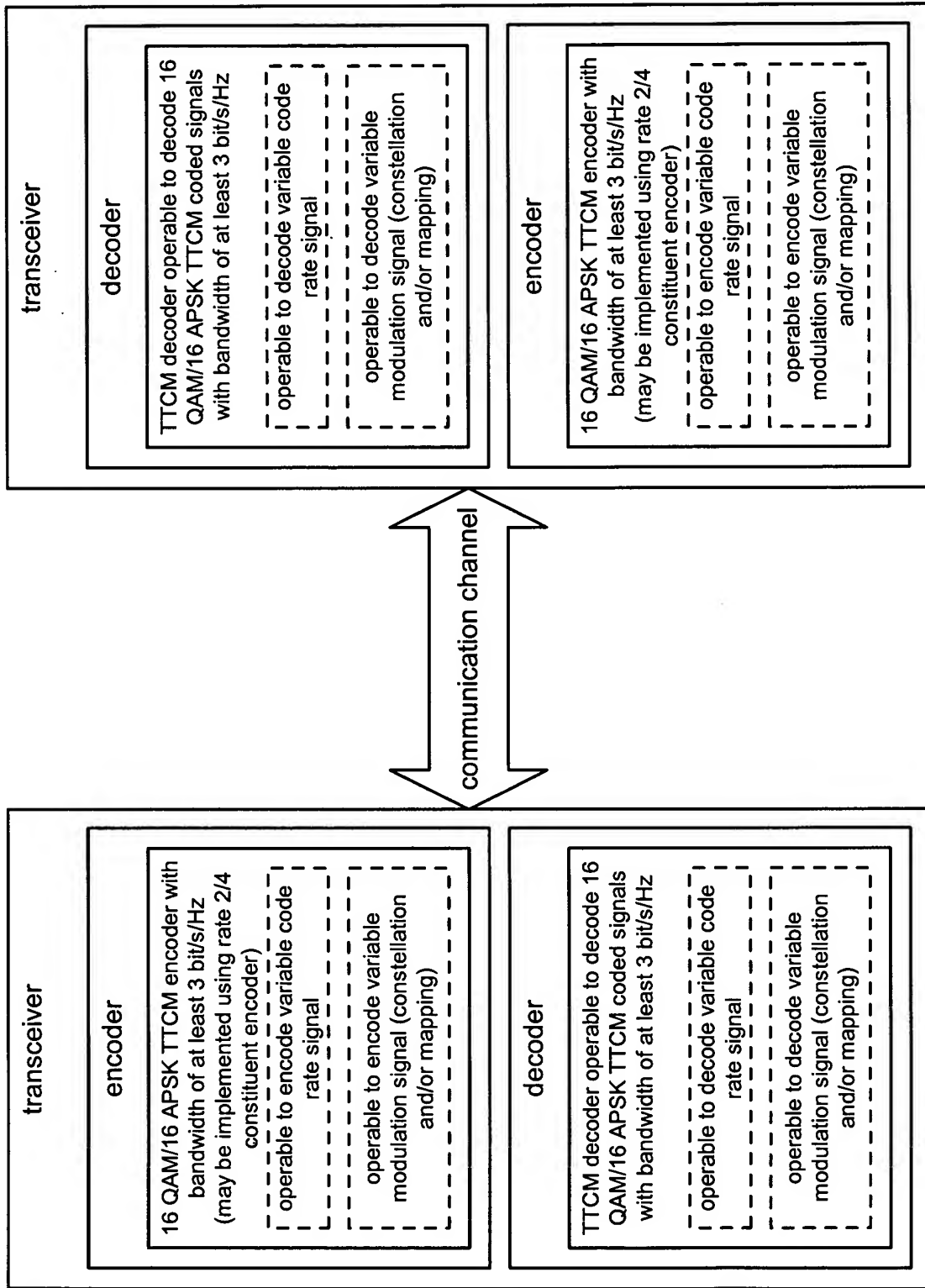
bi-directional point-to-point radio communication system

**Fig. 8**



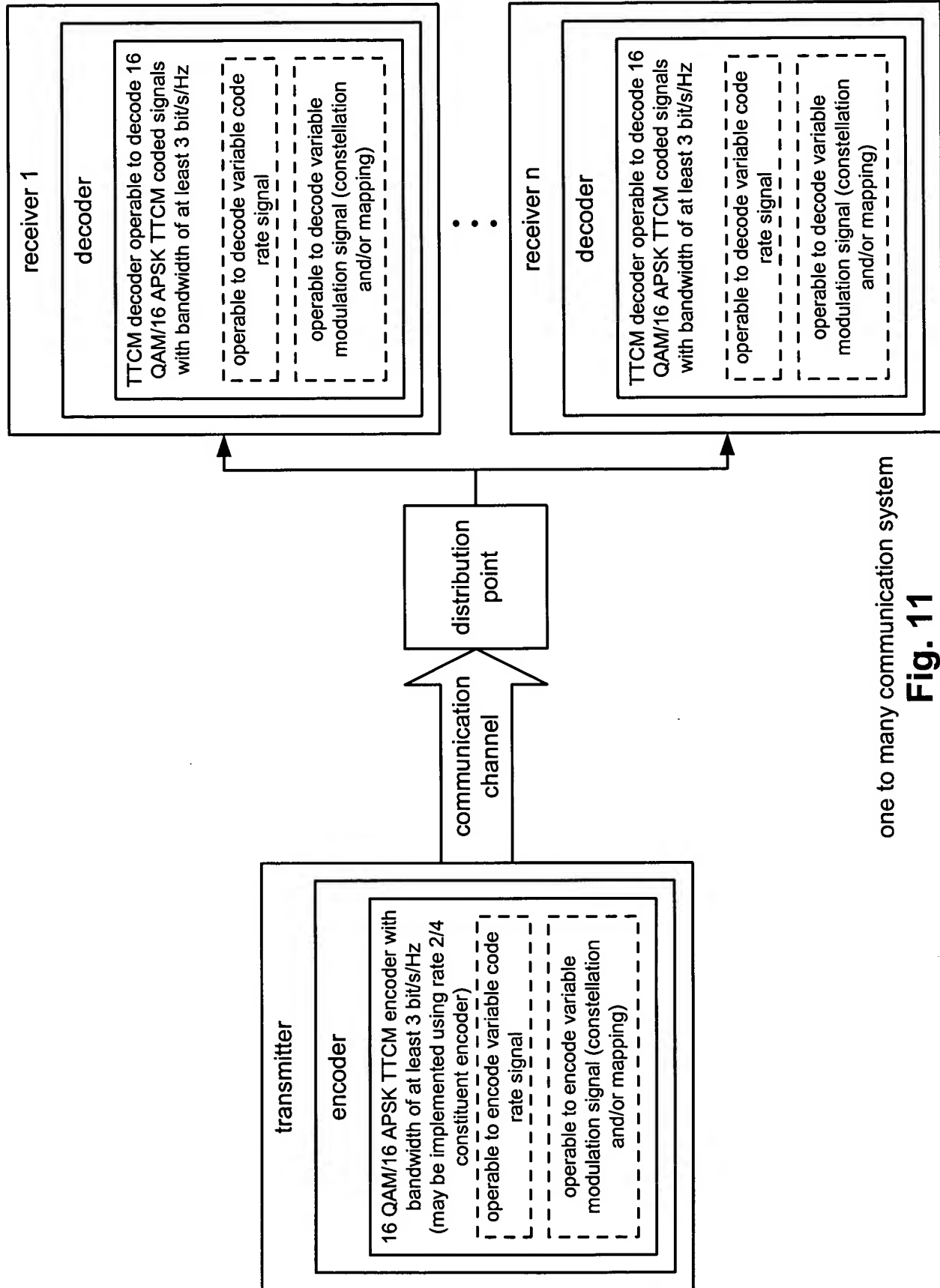


uni-directional communication system  
**Fig. 9**



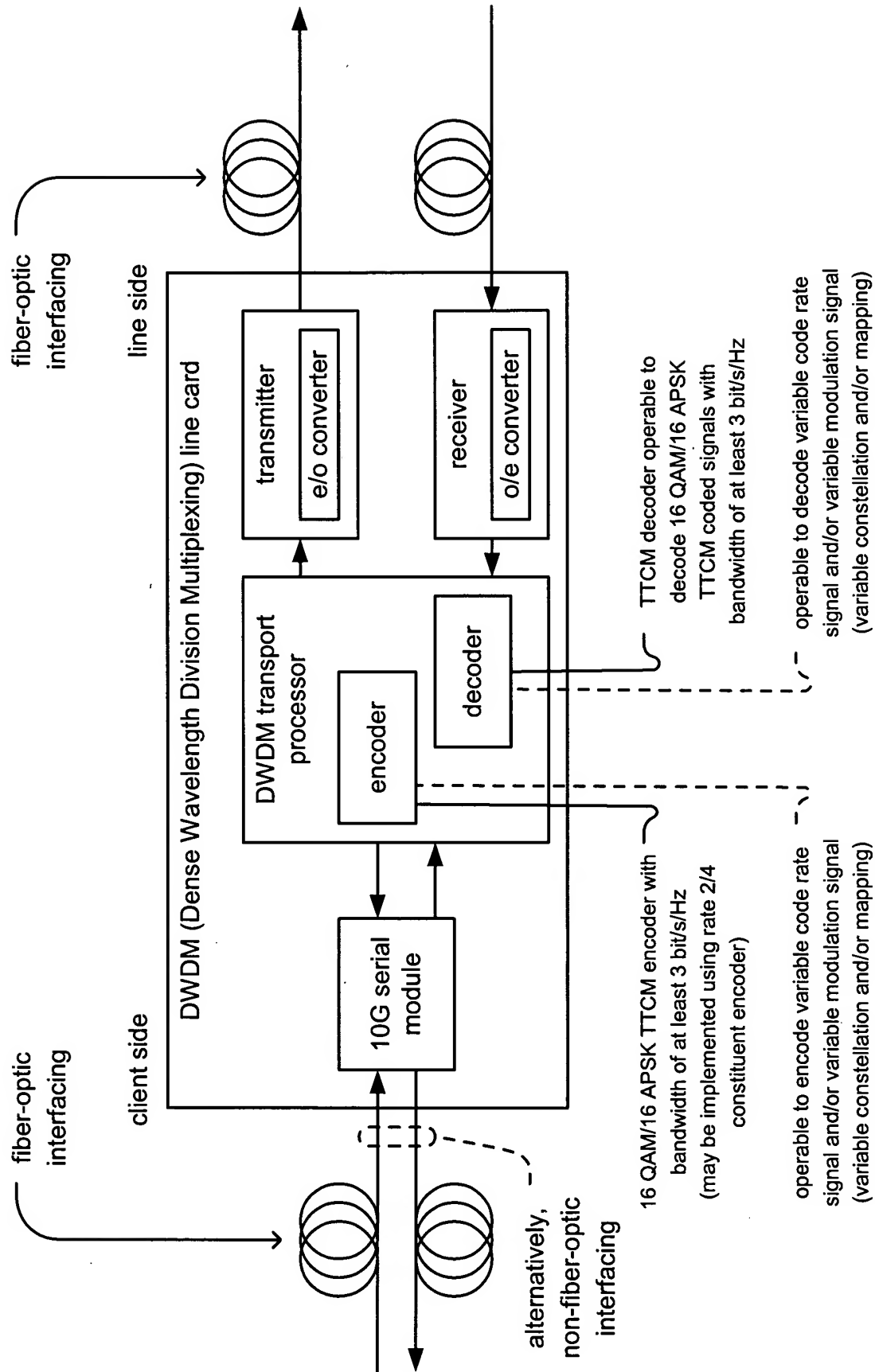
bi-directional communication system

**Fig. 10**



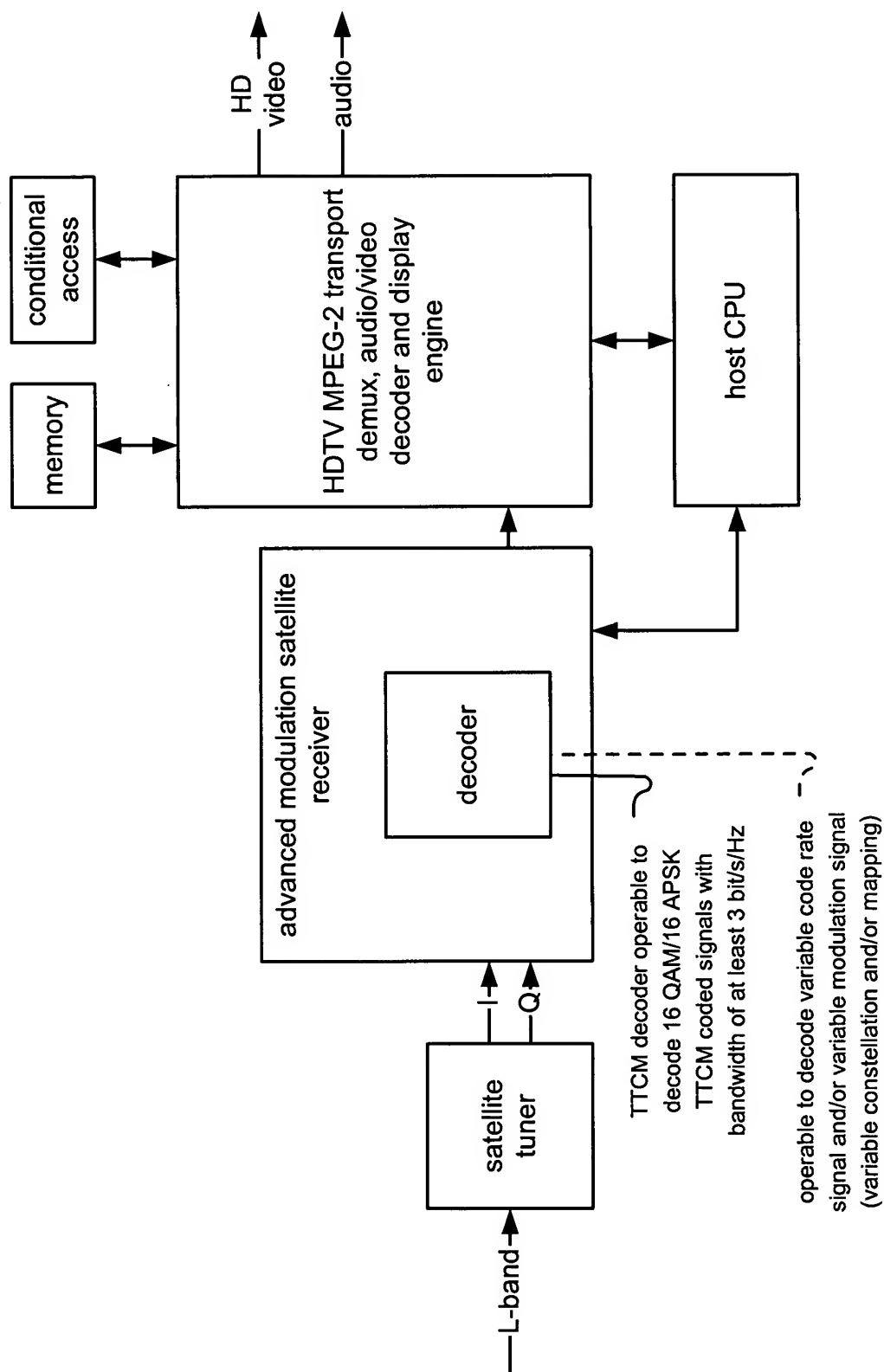
one to many communication system

**Fig. 11**



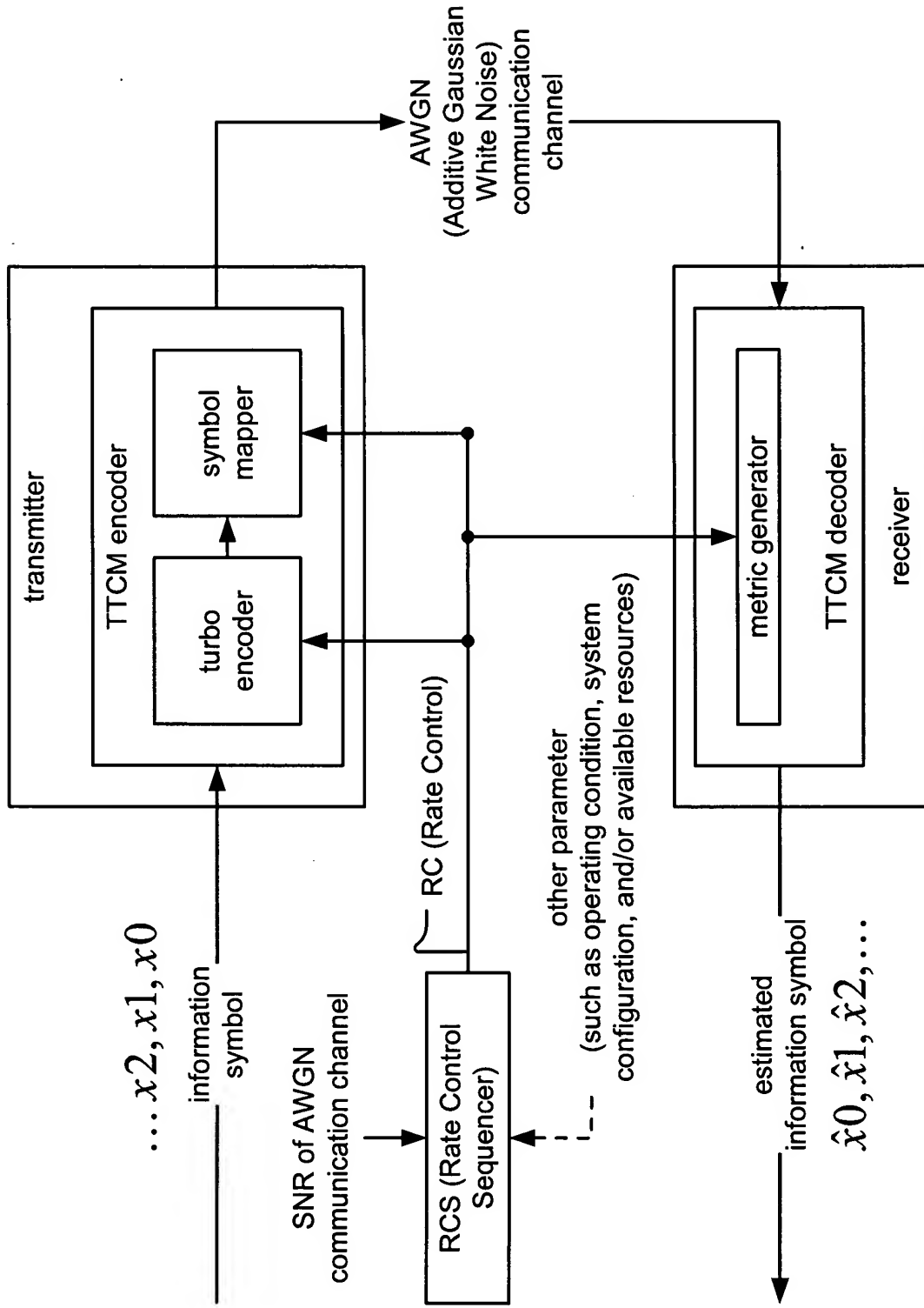
fiber-optic communication system

**Fig. 12**



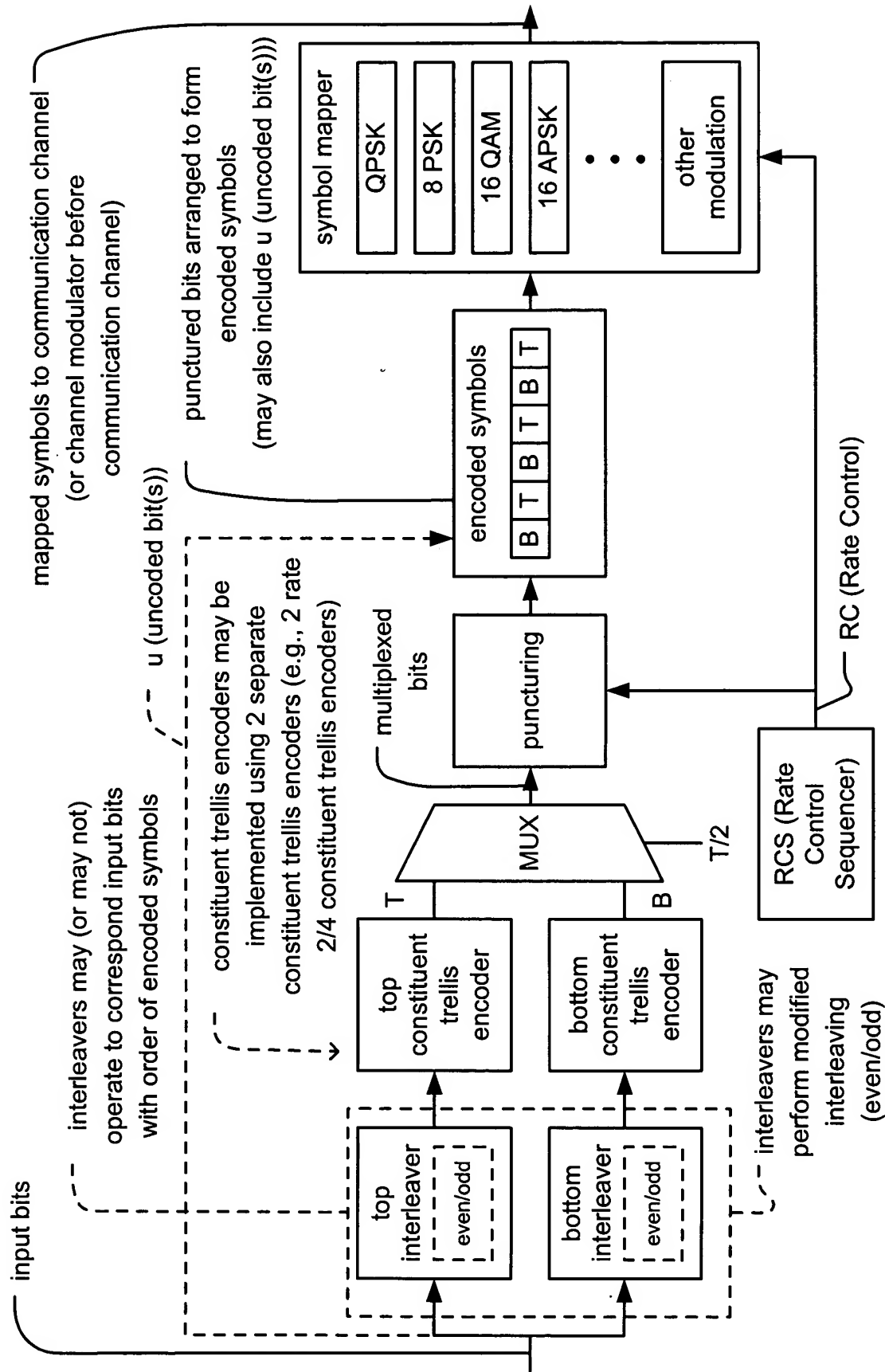
**satellite receiver STB (Set Top Box) system**

**Fig. 13**



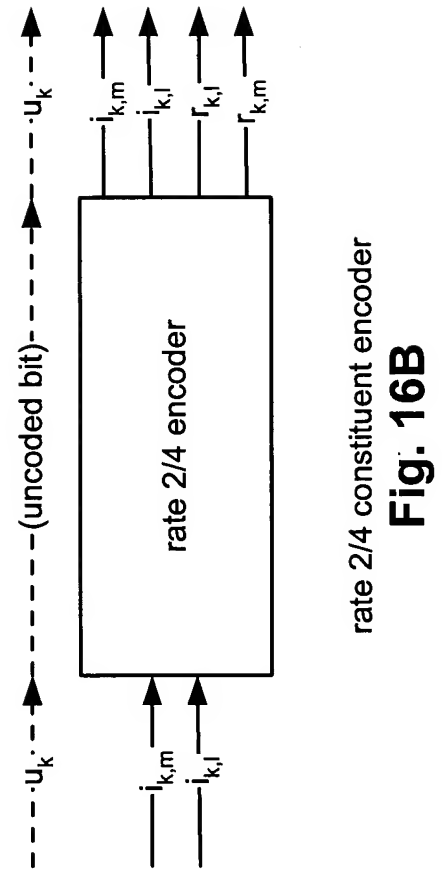
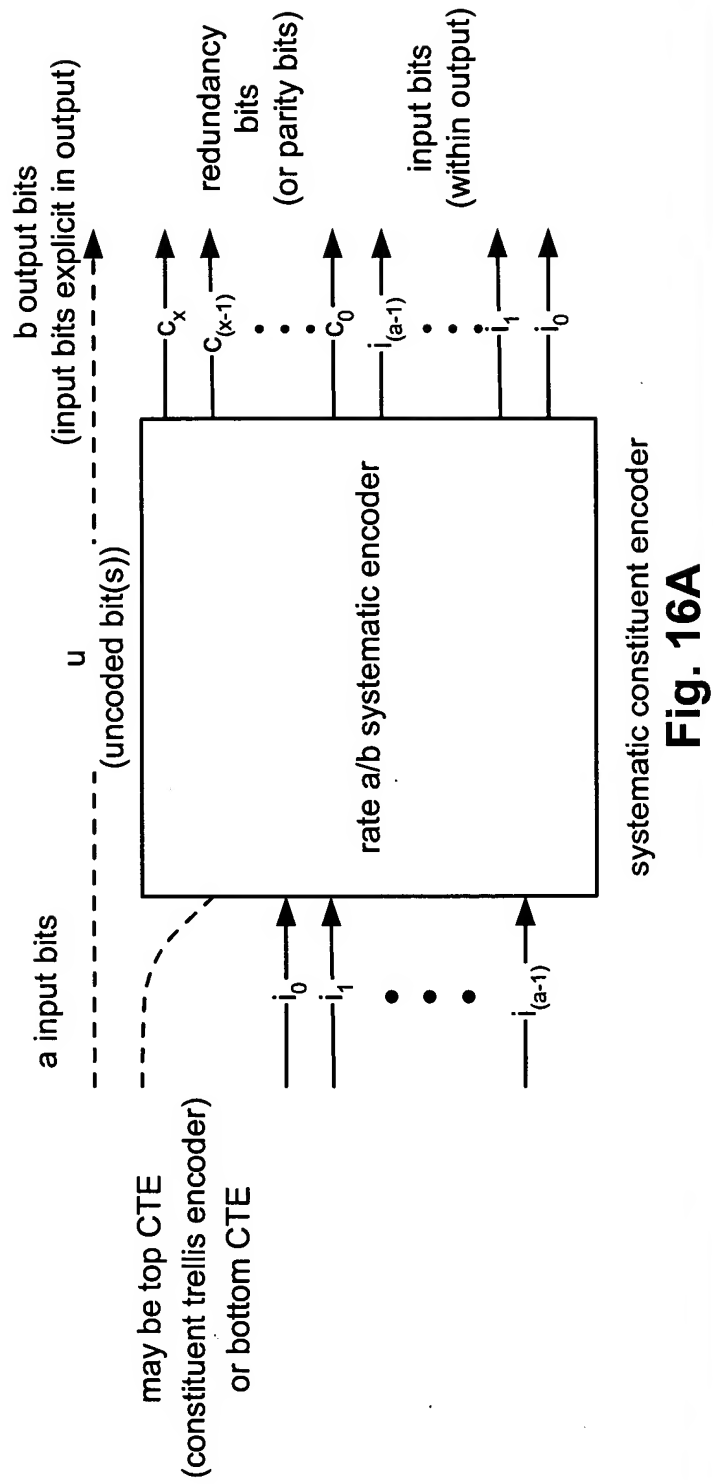
TTCM (Turbo Trellis Coded Modulation) communication system

**Fig. 14**

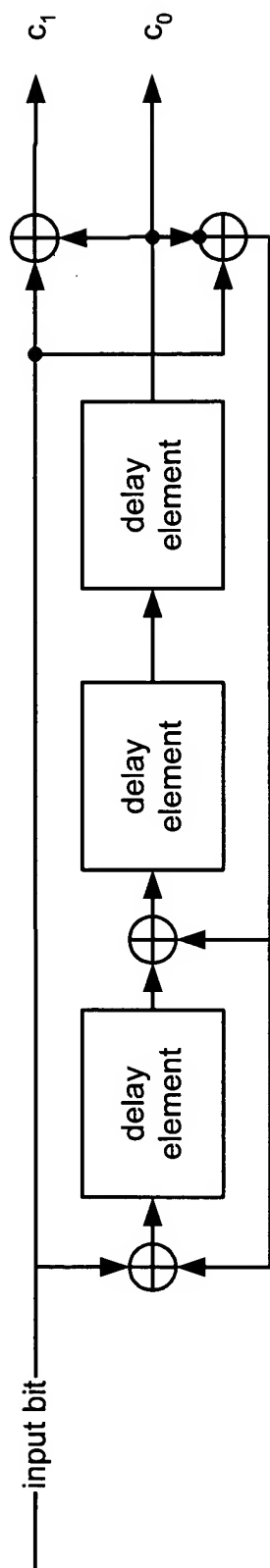


dual interleaver embodiment of TTCM (Turbo Trellis Coded Modulation) encoder

**Fig. 15**

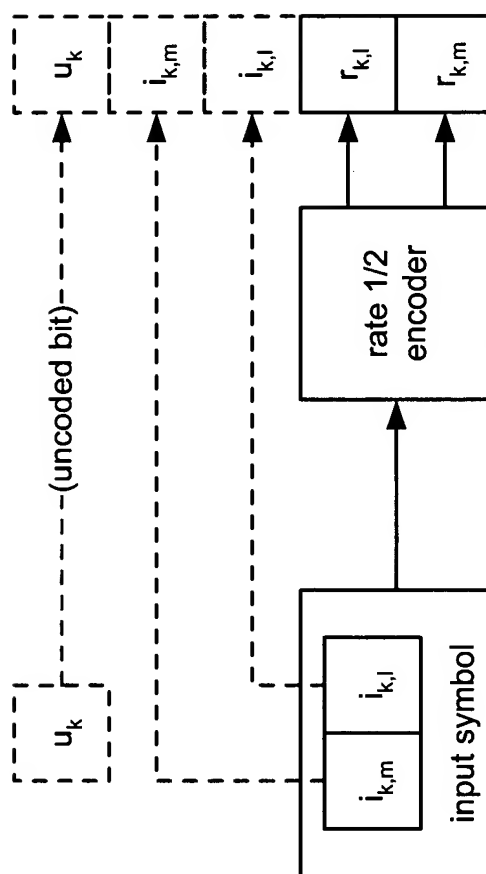






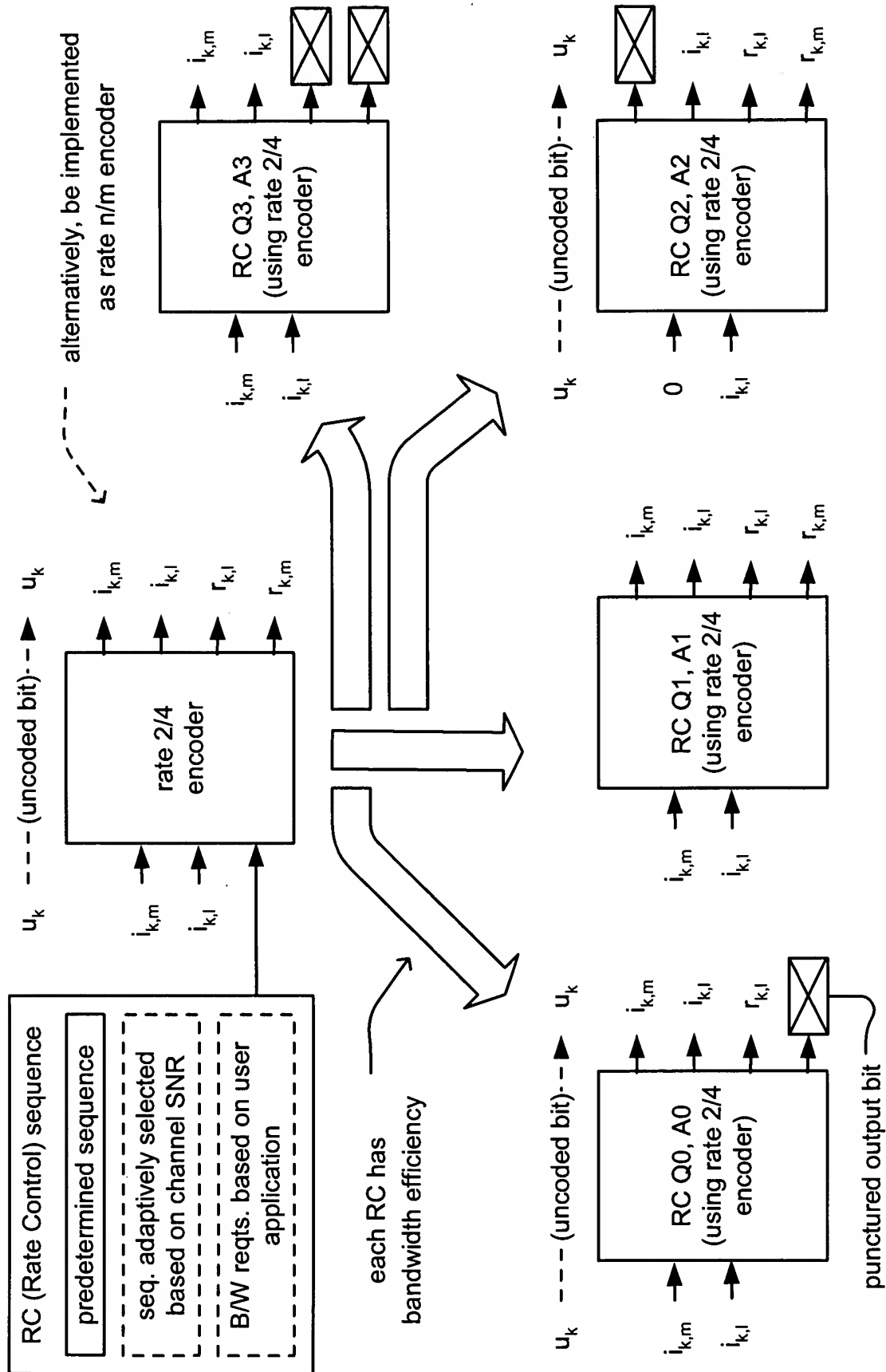
rate 1/2 recursive convolutional encoder with non-systematic output

**Fig. 17A**



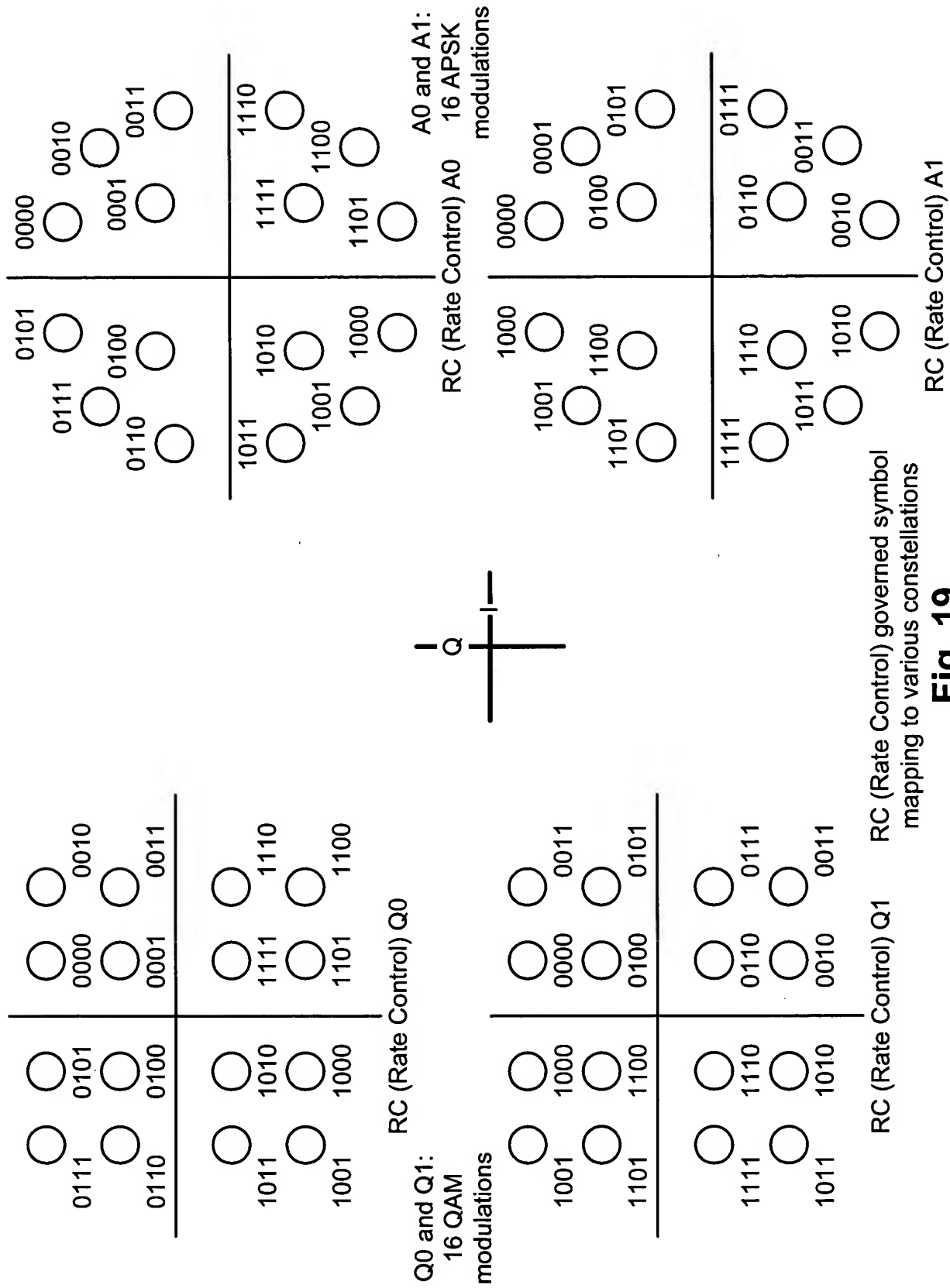
rate 2/4 prototype encoder

**Fig. 17B**



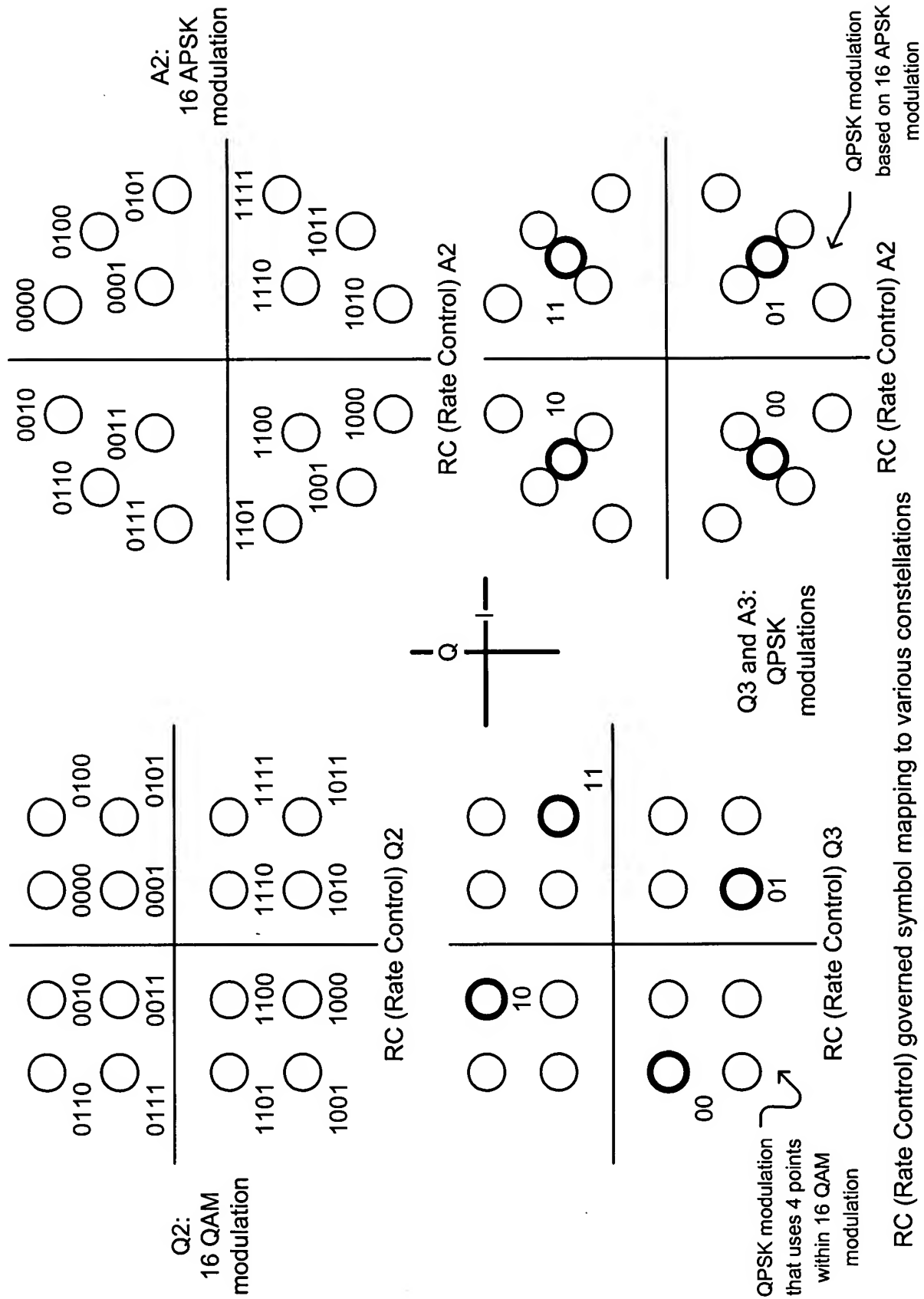
rate 2/4 prototype encoder supporting multiple encoders

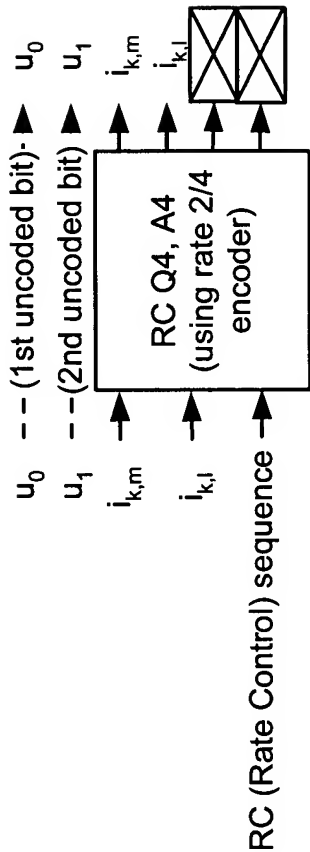
**Fig. 18**



**Fig. 19**

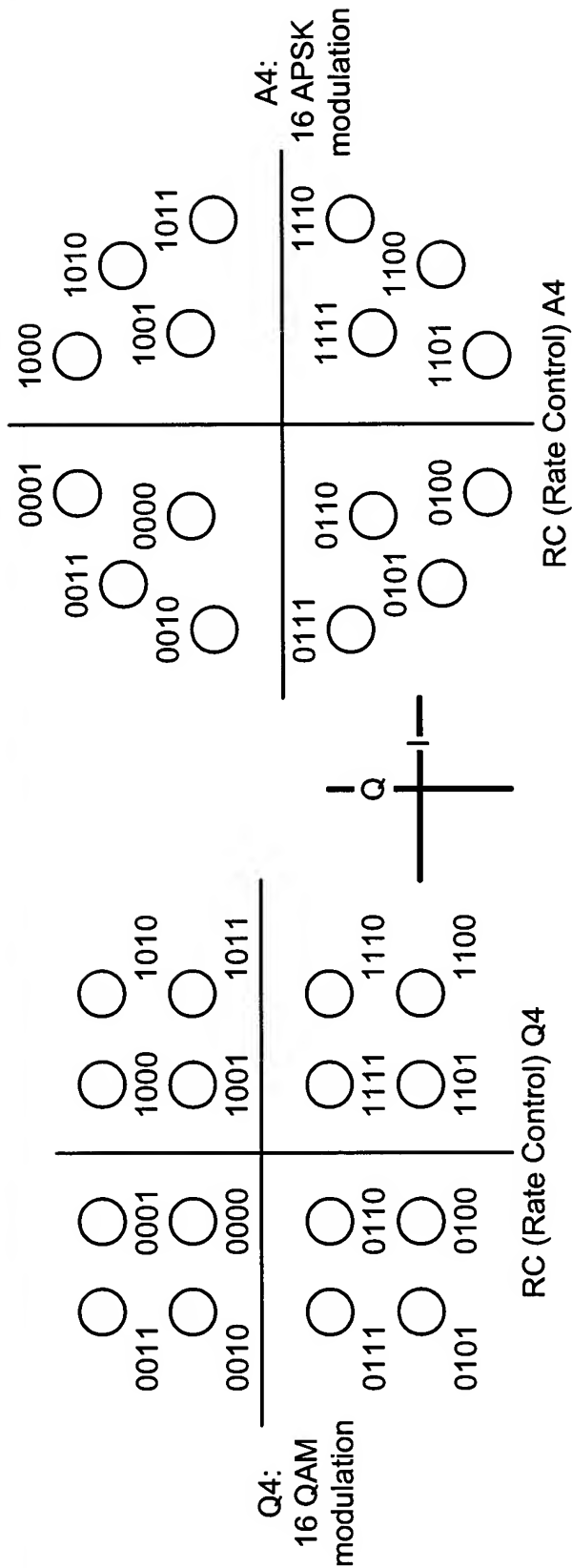
RC (Rate Control) governed symbol mapping to various constellations





rate 2/4 prototype encoder supporting RCs Q4, A4 (each having 2 uncoded bits)

**Fig. 21A**



RC (Rate Control) governed symbol mapping to various constellations

**Fig. 21B**

bandwidth	a period of a sequence for 16 QAM	a period of a sequence for 16 APSK
3.33 bit/s/Hz	Q0 Q0 Q4 Q4	A0 A0 A4 A4
3.5 bit/s/Hz	Q0 Q0 Q4 Q4	A0 A0 A4 A4

periodic RC (Rate Control) sequences of TTCM supporting bandwidths of at least 3 bit/s/Hz

Fig. 22A

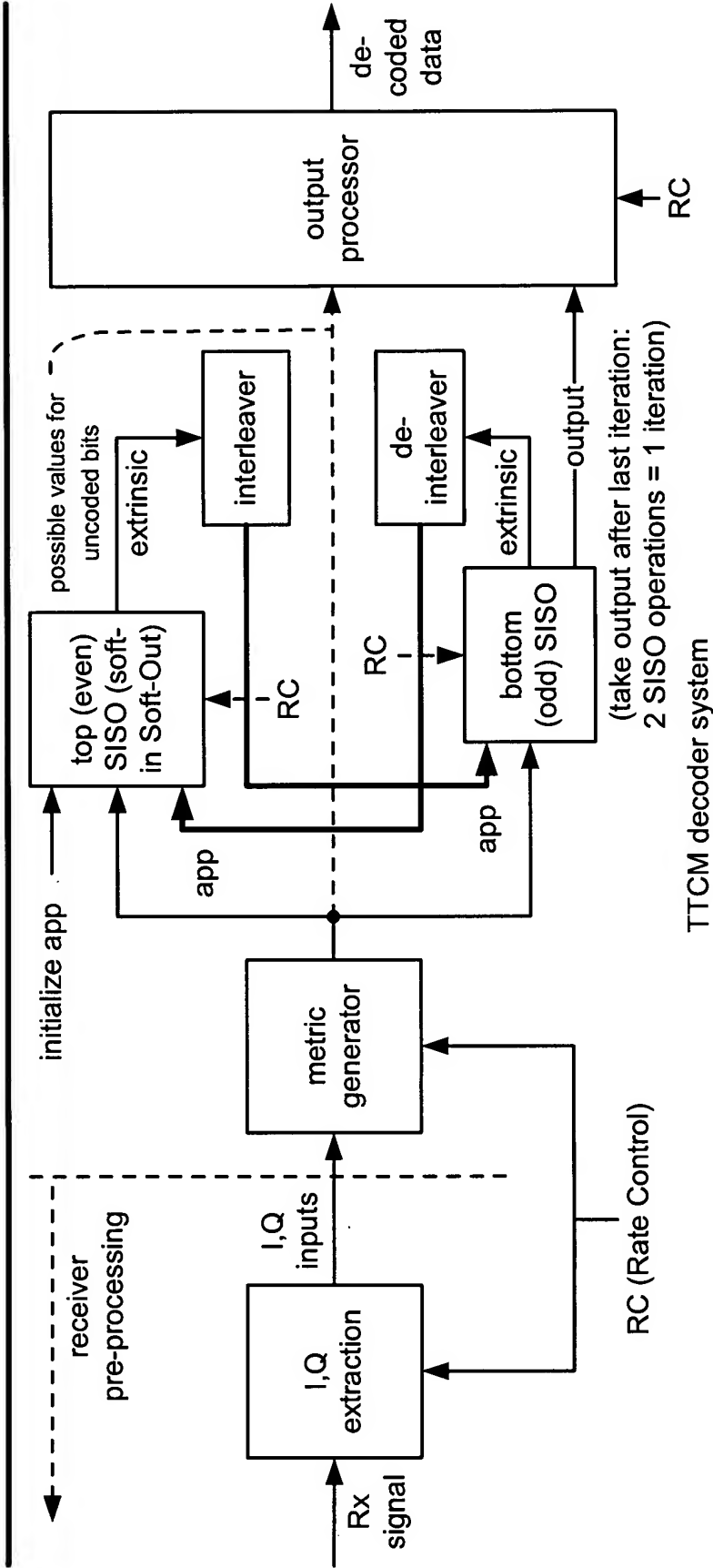
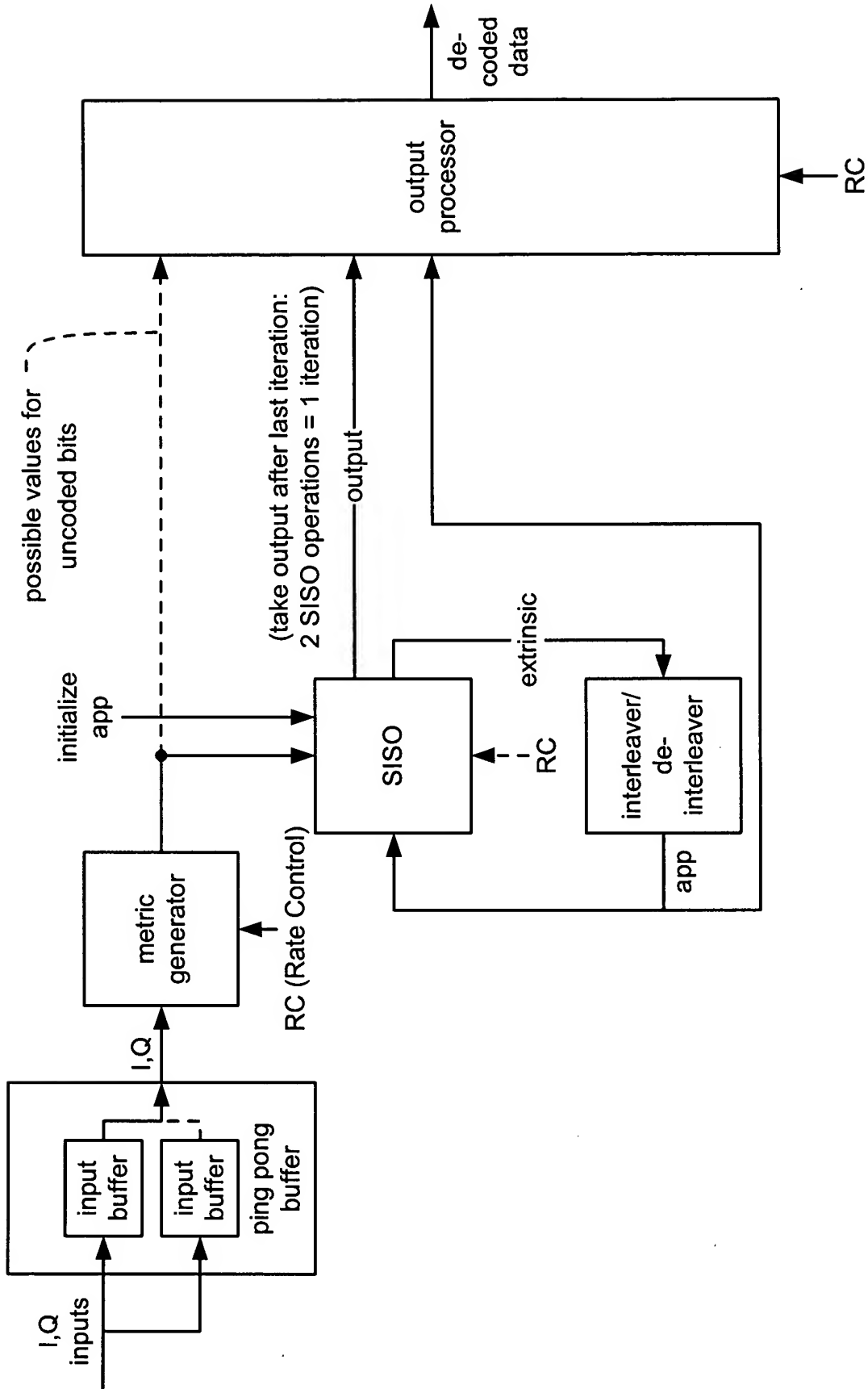


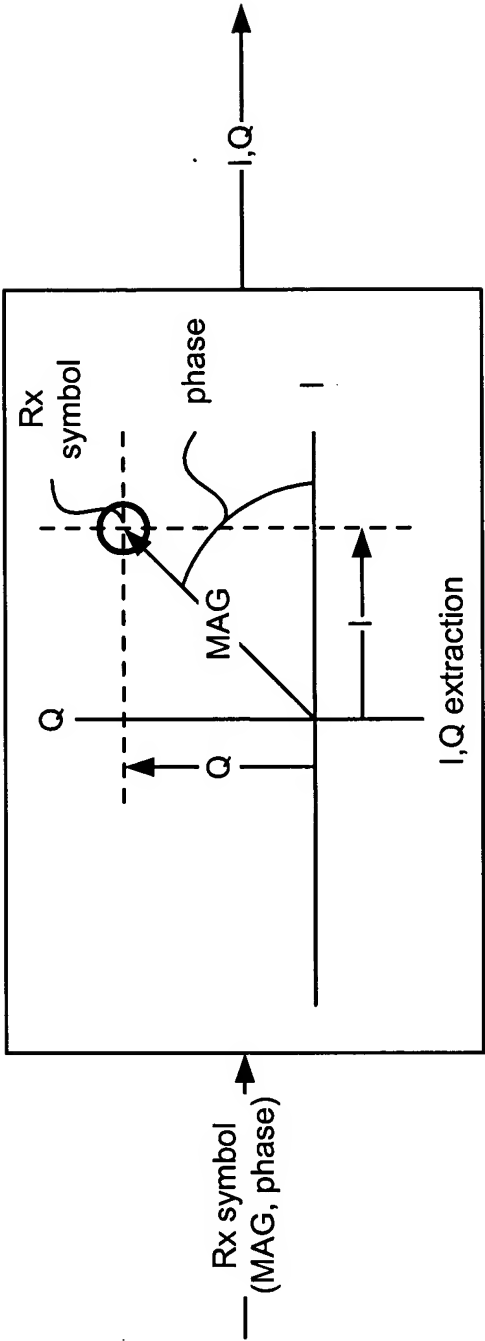
Fig. 22B

TTCM decoder system



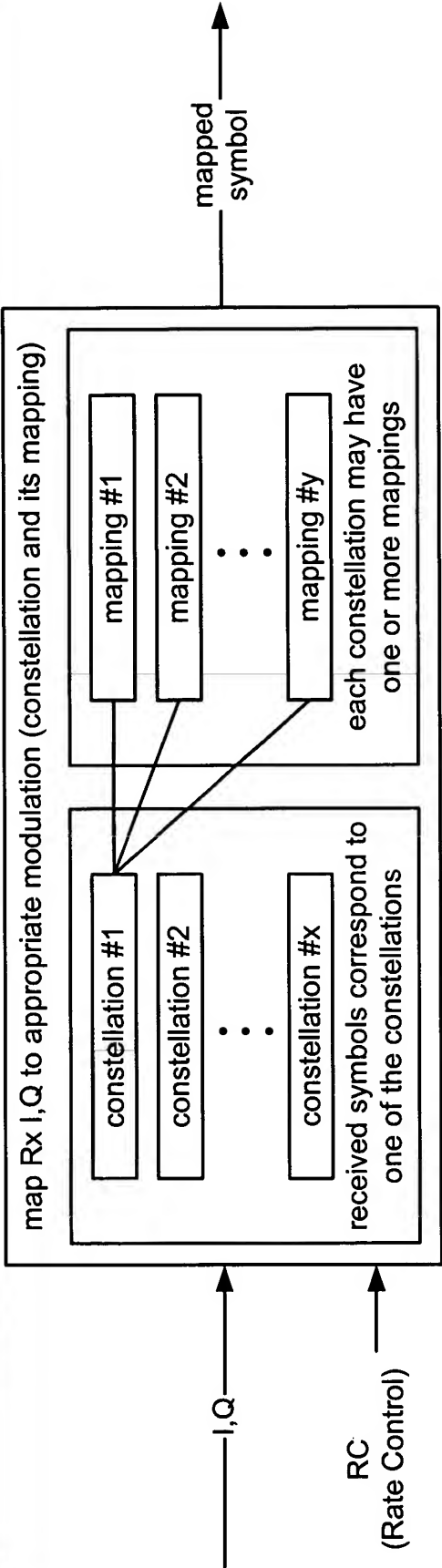
alternative TTCM decoder system that recycles single SISO (receiving I,Q inputs)

**Fig. 23**



I, Q (In-phase, Quadrature) extraction

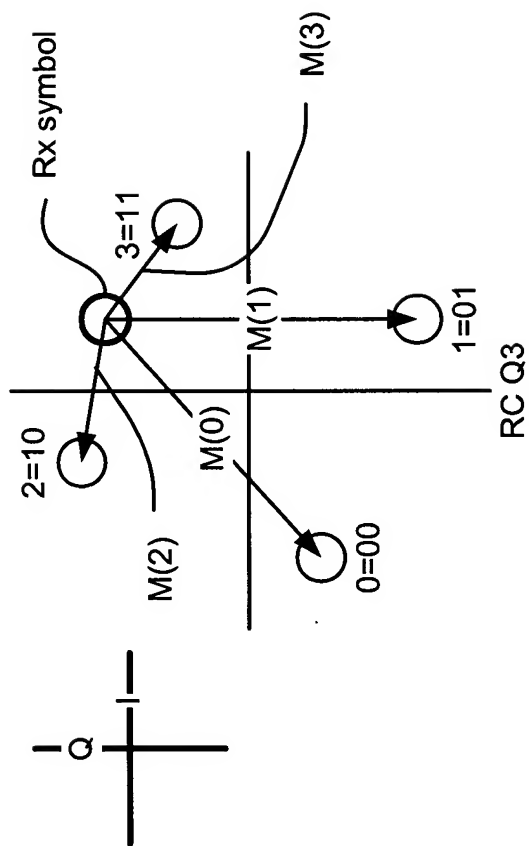
Fig. 24A



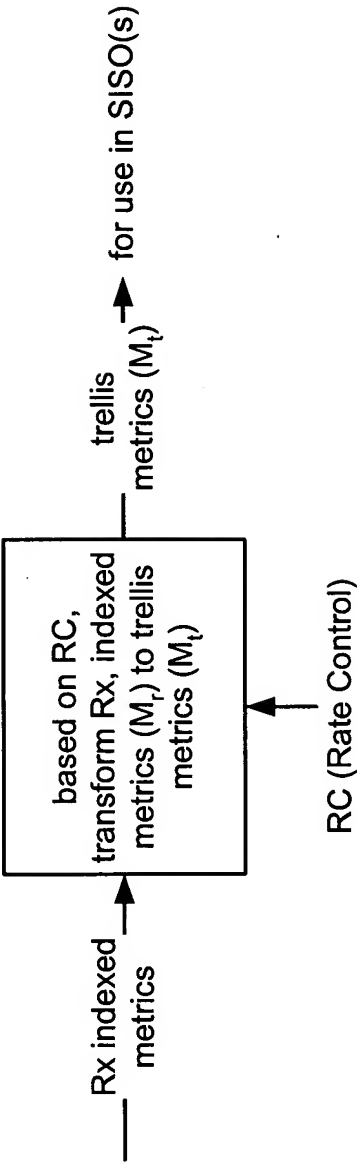
Rx I, Q mapping based on RC

Fig. 24B

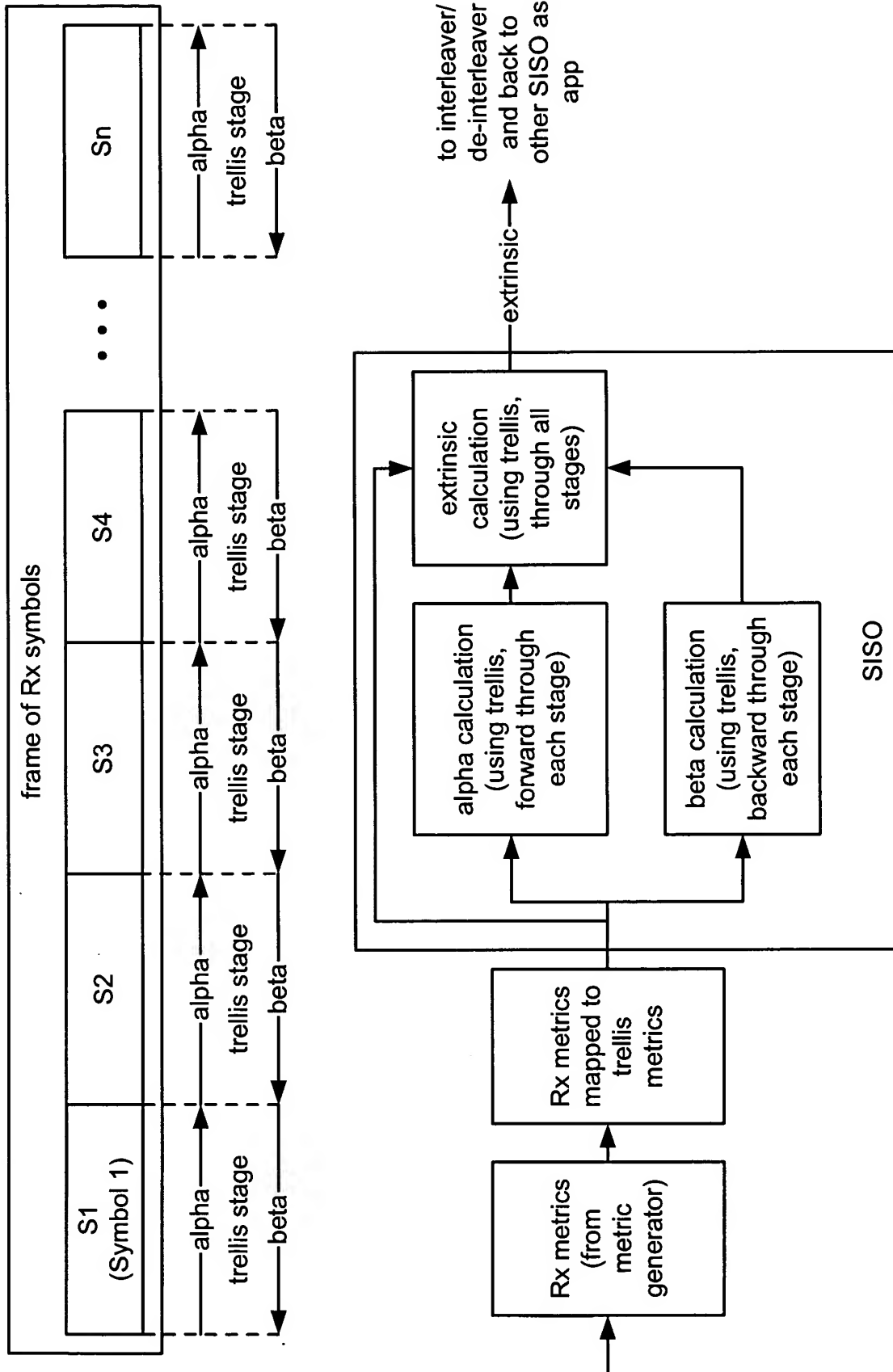




metric calculation performed by metric generator (shown for RC Q3 embodiment)  
**Fig. 25A**

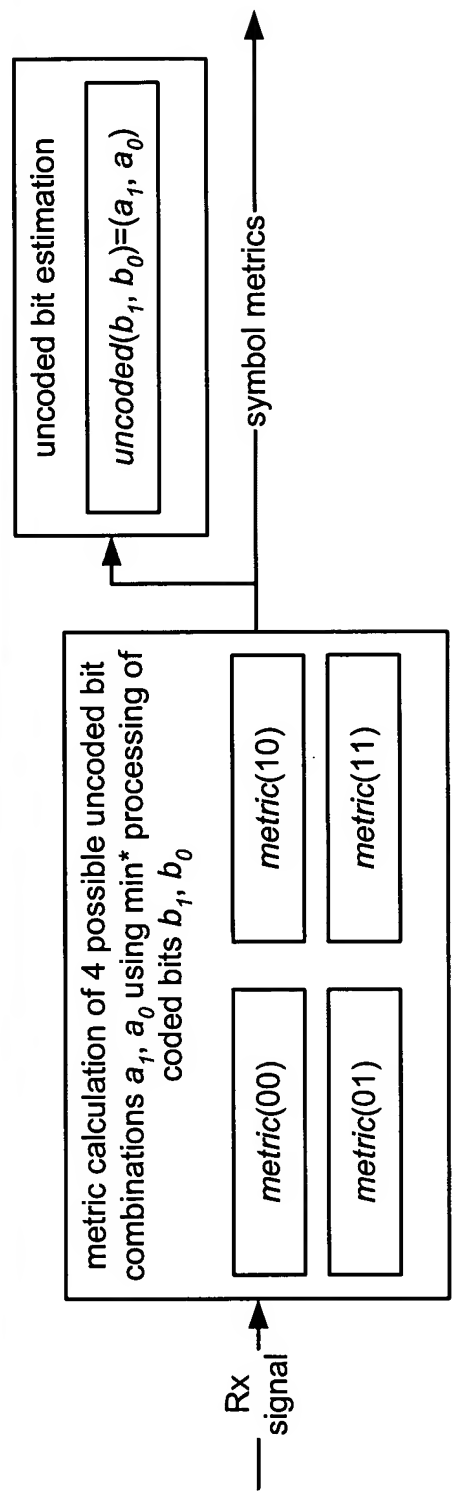
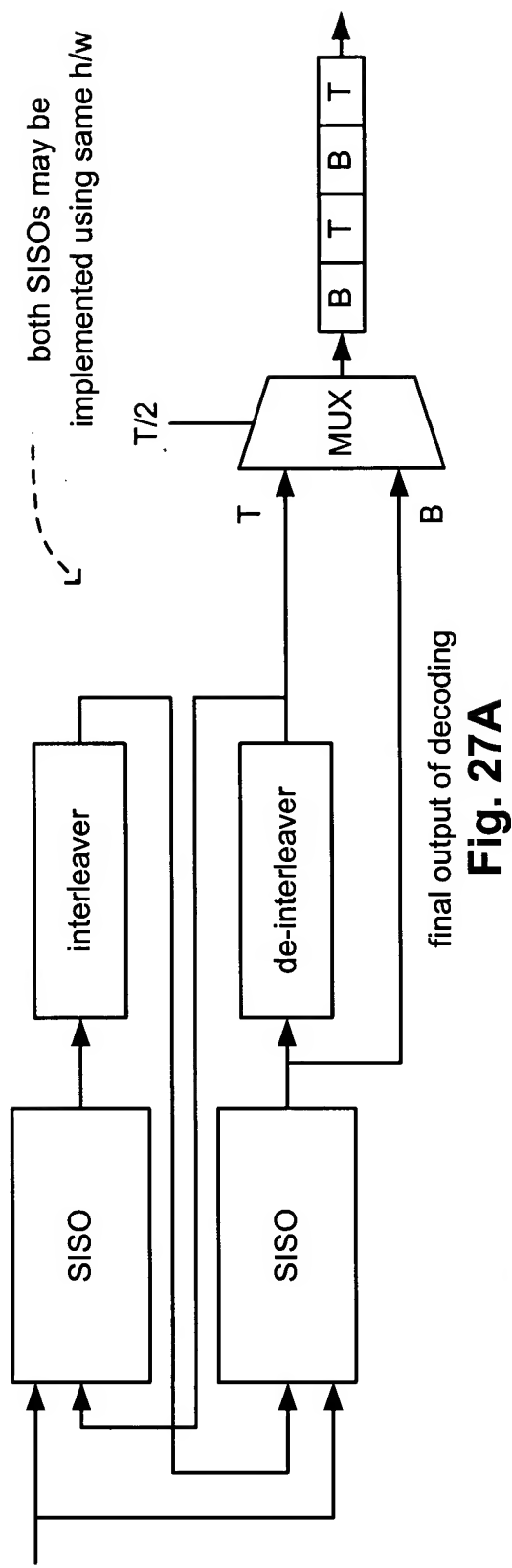


metric mapping functionality  
**Fig. 25B**



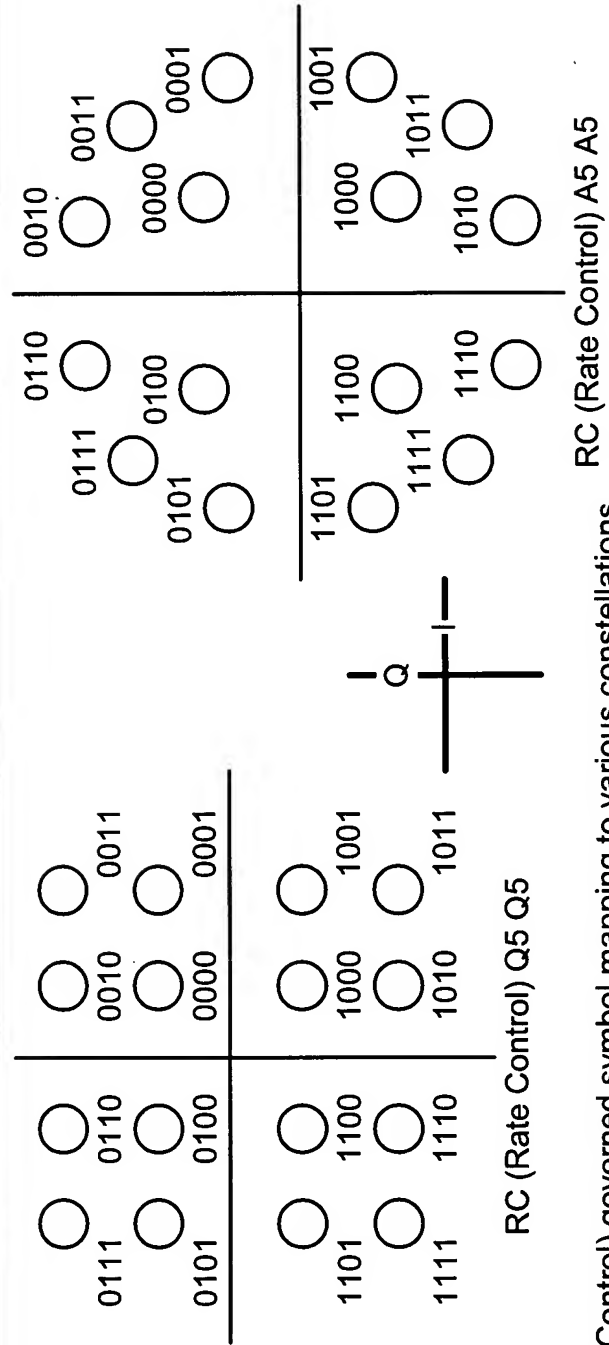
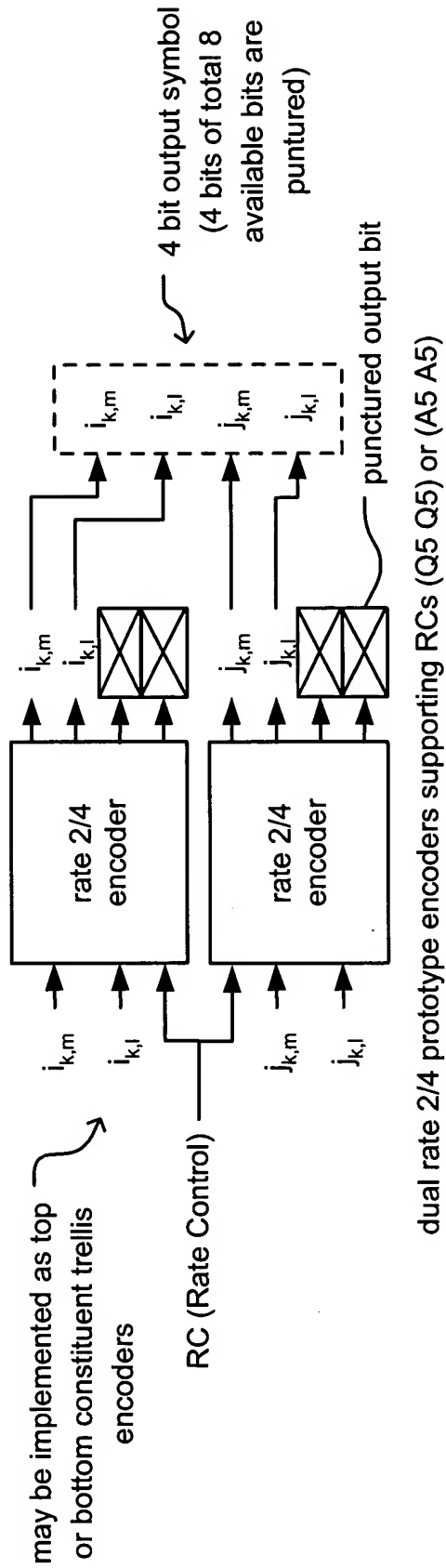
SISO calculations and operations

**Fig. 26**



metric generator computation to accommodate RCs Q4 and A4

**Fig. 27B**



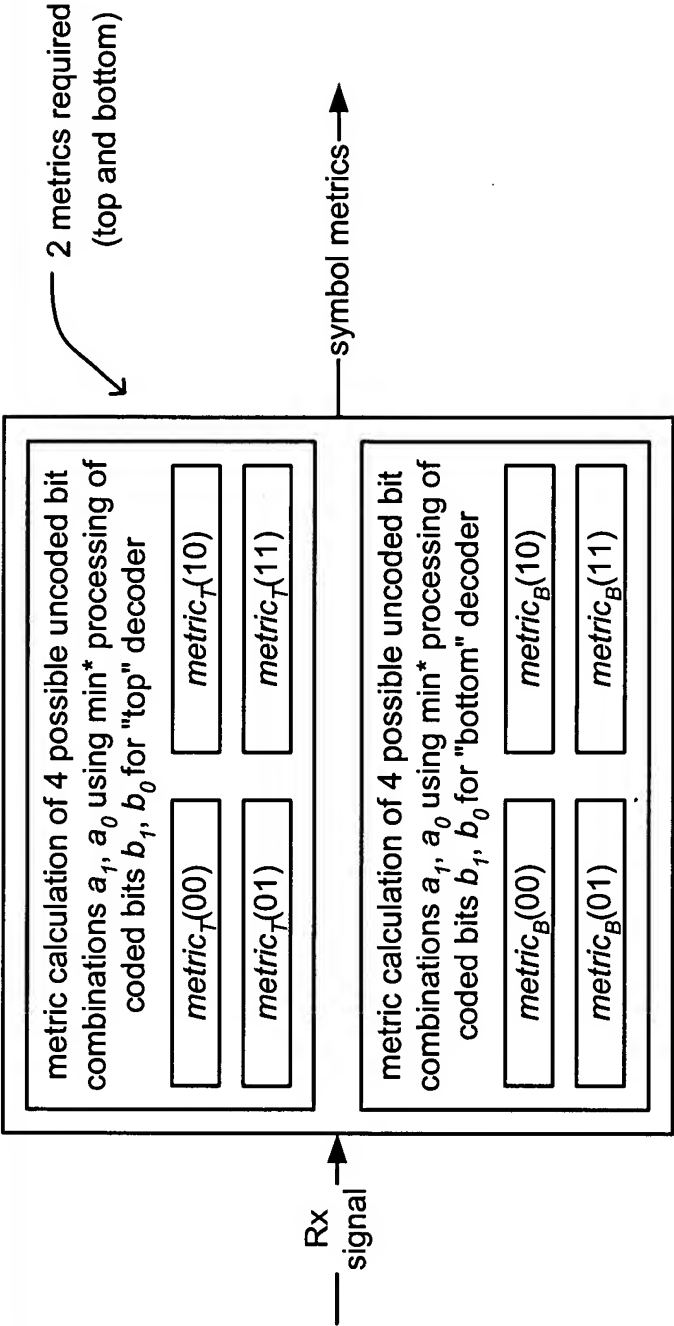
RC (Rate Control) governed symbol mapping to various constellations

Fig. 28B

bandwidth	a period of a sequence for 16 QAM	a period of a sequence for 16 APSK
3.33 bit/s/Hz	Q0 Q0 (Q5 Q5)	A0 A0 (A5 A5)
3.5 bit/s/Hz	Q0 Q0 (Q5 Q5) (Q5 Q5)	A0 A0 (A5 A5) (A5 A5)

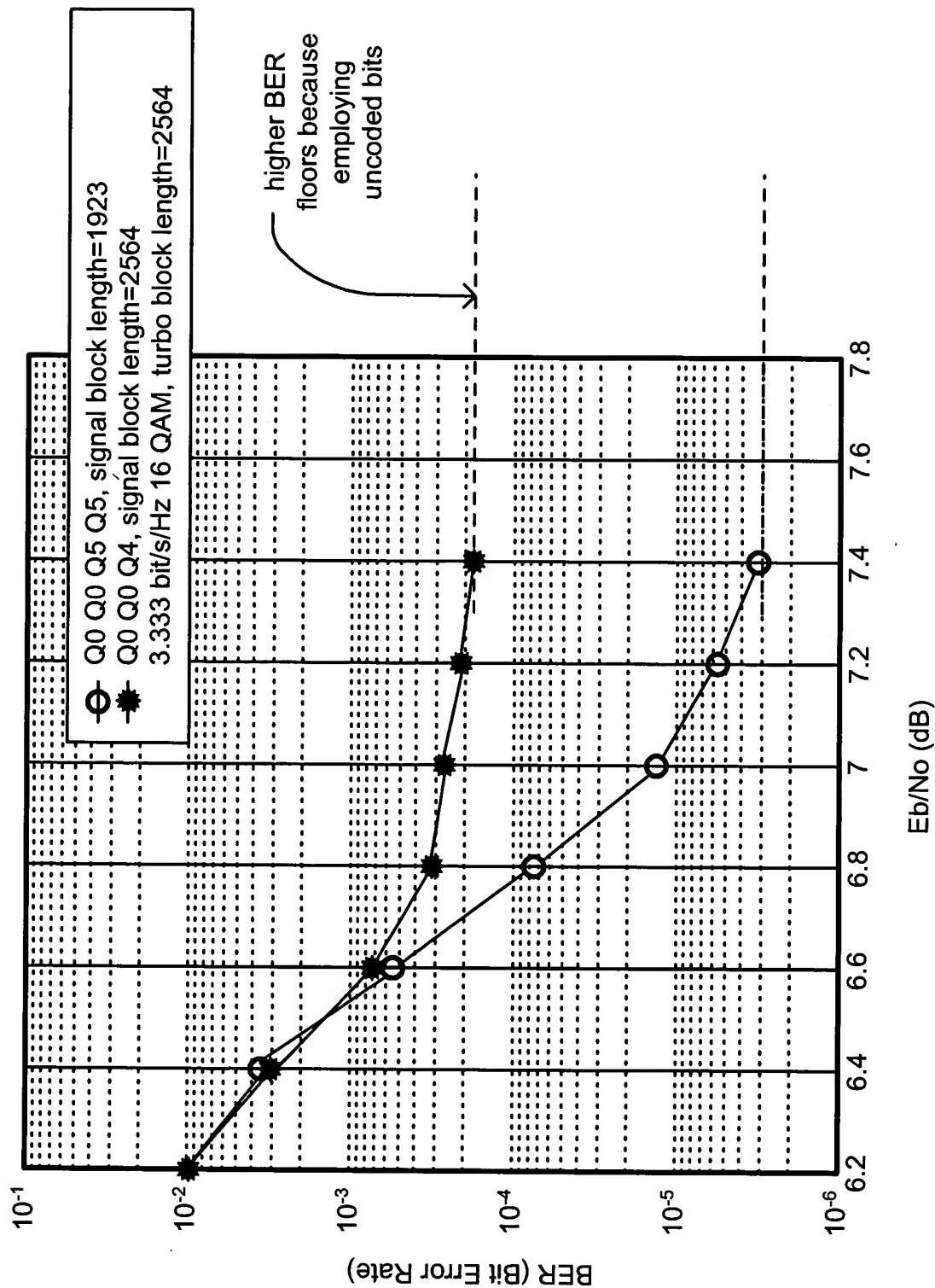
periodic RC (Rate Control) sequences supporting TTCM supporting bandwidth of at least 3 bit/s/Hz

Fig. 29A



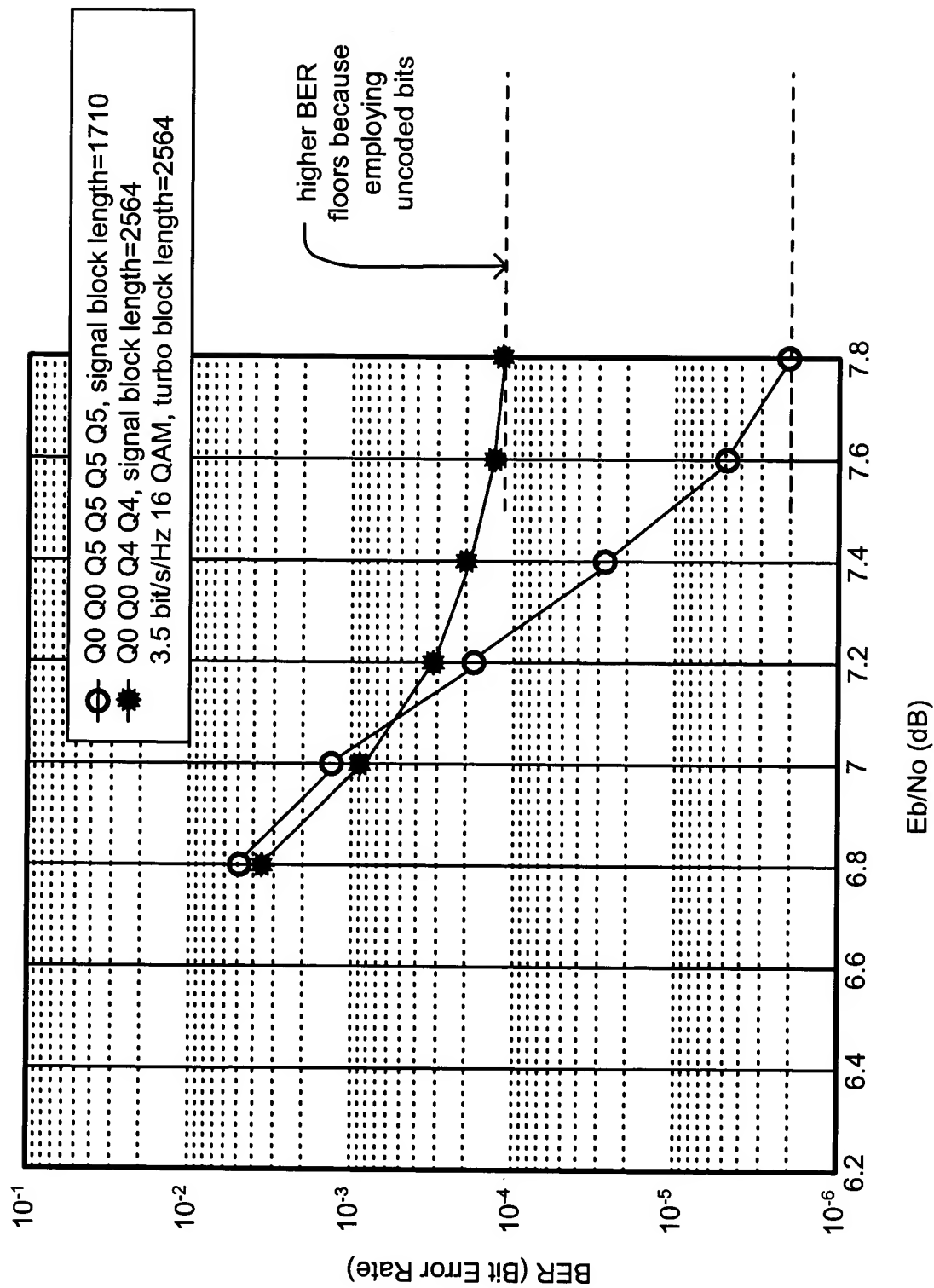
metric generator computation to accommodate RCs (Q5 Q5) and (A5 A5)

Fig. 29B



performance of 3.33 bit/s/Hz 16 QAM TTCM (shown with 4 decoding iterations)

**Fig. 30**



performance of 3.5 bit/s/Hz 16 QAM TTCM (shown with 4 decoding iterations)

**Fig. 31**

bandwidth	a period of a sequence for 16 QAM (period 9)	a period of a sequence for 16 APSK (period 9)
3.0 bit/s/Hz	Q4 Q0 Q0 Q0 Q0 Q0 Q0 Q0 Q3, or (Q5 Q5) Q0 Q0 Q0 Q0 Q0 Q0 Q0 Q3	A4 A0 A0 A0 A0 A0 A0 A0 A3, or (A5 A5) A0 A0 A0 A0 A0 A0 A0 A3
3.11 bit/s/Hz	Q4 Q0 Q0 Q0 Q4 Q0 Q0 Q0 Q3, or (Q5 Q5) Q0 Q0 Q0 (Q5 Q5) Q0 Q0 Q0 Q3	A4 A0 A0 A0 A4 A0 A0 A0 A3, or (A5 A5) A0 A0 A0 (A5 A5) A0 A0 A0 A3
3.33 bit/s/Hz	Q4 Q4 Q0 Q0 Q4 Q4 Q0 Q0 Q3, or (Q5 Q5) (Q5 Q5) Q0 Q0 (Q5 Q5) (Q5 Q5) Q0 Q0 Q3	A4 A4 A0 A0 A4 A4 A0 A0 A3, or (A5 A5) (A5 A5) A0 A0 (A5 A5) (A5 A5) A0 A0 A3

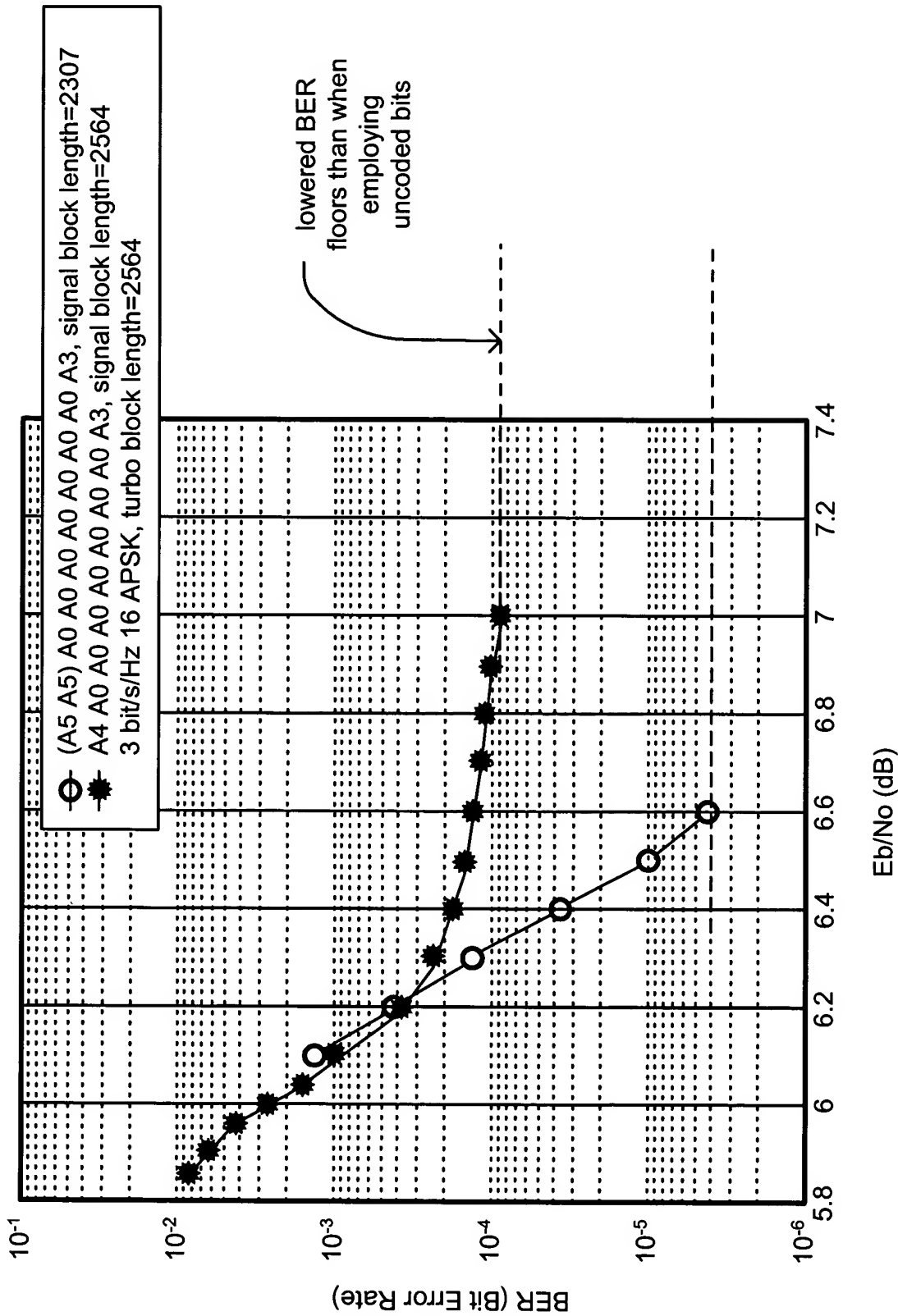
RC sequences include combined 16 QAM and QPSK (Q3) modulations

RC sequences include combined 16 APSK and QPSK (A3) modulations

combined modulation periodic RC sequences supporting TTCM supporting bandwidth of at least 3 bit/s/Hz

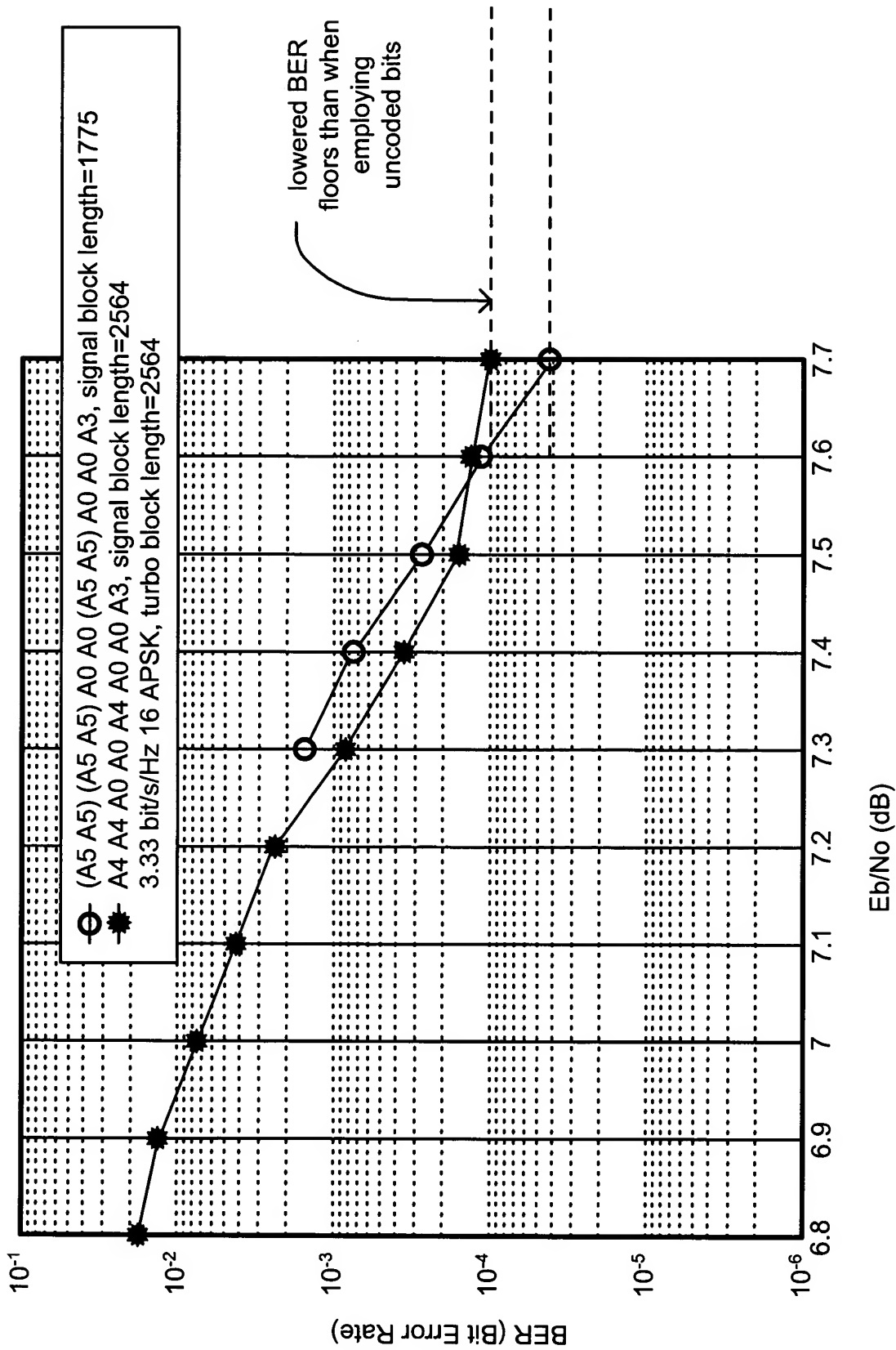
Fig. 32





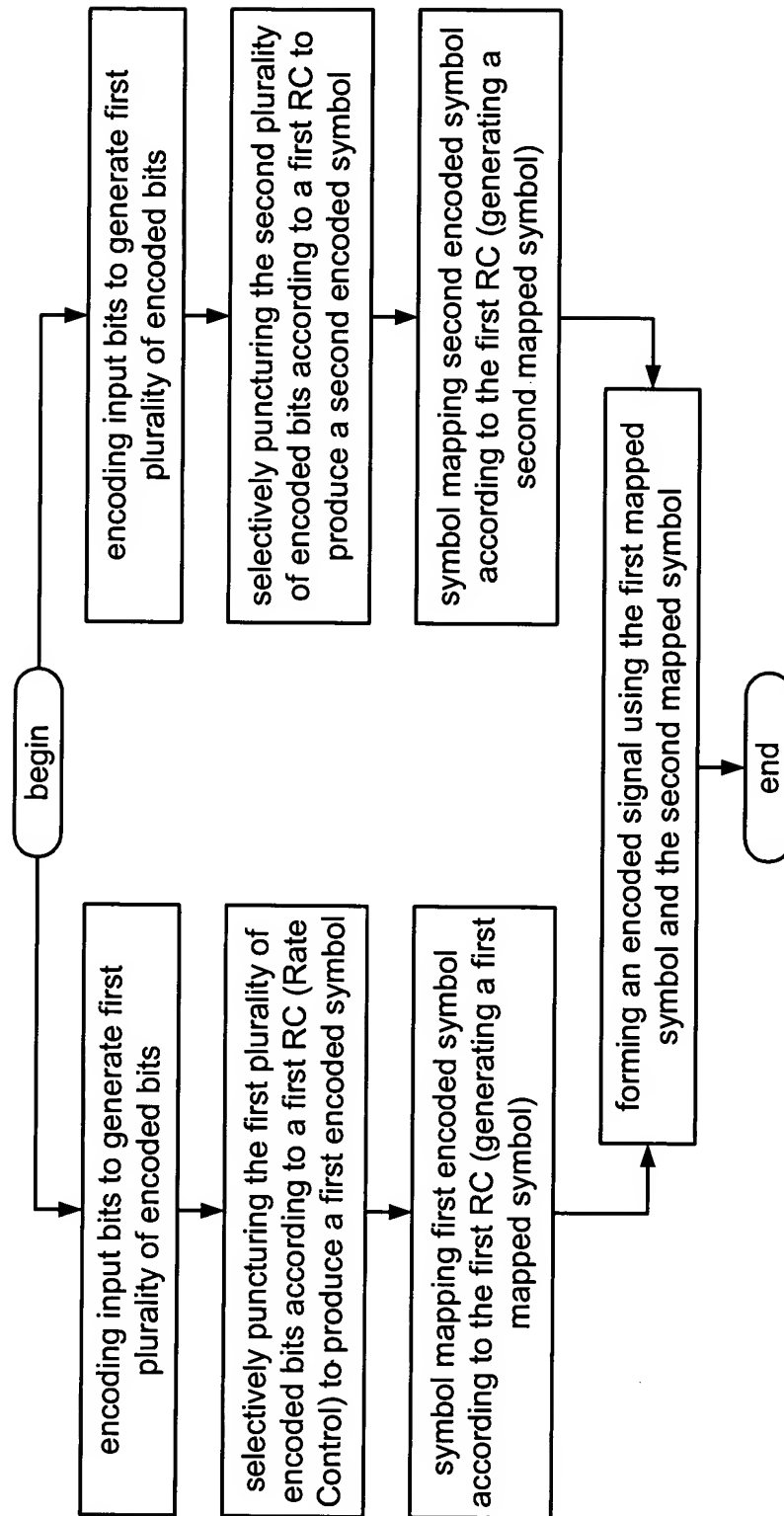
performance of 3.0 bit/s/Hz 16 APSK TCM (shown with 4 decoding iterations)

**Fig. 33**



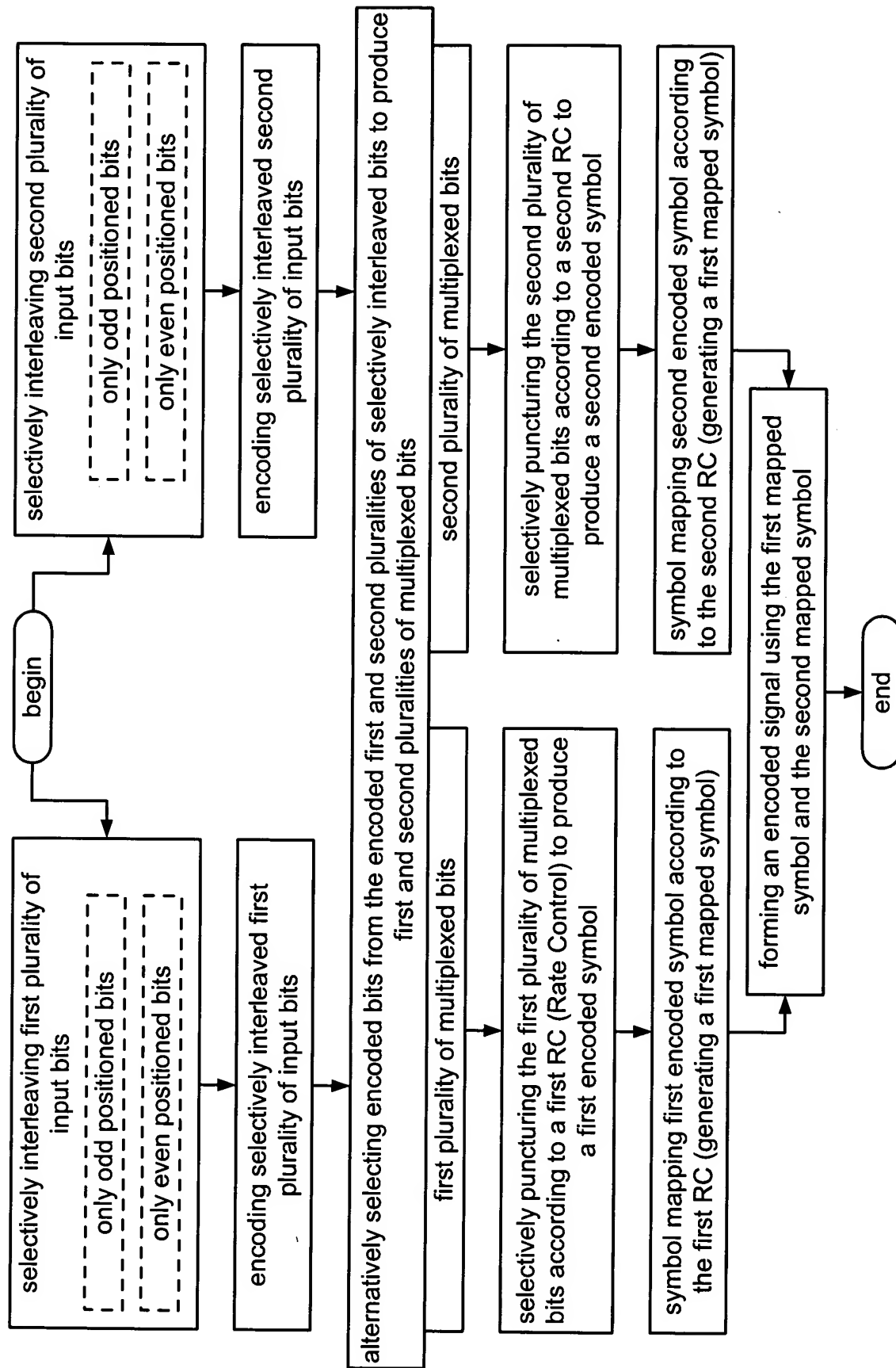
performance of 3.33 bit/s/Hz 16 APSK TCM (shown with 4 decoding iterations)

**Fig. 34**



TTCM (Turbo Trellis Coded Modulation) encoding method

**Fig. 35**



TTCM (Turbo Trellis Coded Modulation) encoding method

**Fig. 36**